ADI Limited
Engineers, Architects, Planners,
Management Consultants, Surveyors

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STUDY OF MARKETS FOR AGGREGATE MATERIALS ACCESSIBLE FROM NOVA SCOTIA AND NEW BRUNSWICK

by
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Canada ~ Nova Scotia
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1.0 SUMMARY OF FINDINGS

1.1 Introduction

Presented on the following pages is a description of the current market for aggregates accessible from New Brunswick and Nova Scotia, as well as a forecast of market potential to the year 2005, and an identification of other relevant factors which could influence aggregate marketing.

1.2 Market Area

Under current transportation and economic conditions, the accessible market area for New Brunswick and Nova Scotia producers is a strip of territory in the United States and Canada within economic truck haul distance of ports on the Saint Lawrence Seaway, the Atlantic Ocean and the Gulf of Mexico. This strip embraces Quebec, Ontario, and nineteen American states.

The Caribbean area is not a viable market at present.

1.3 Product

Sand and gravel are used for a variety of building and civil construction projects. There is significant variation of uses among market territories. Presented below are market territories and the most common uses of sand and gravel (in order) in each territory:

New England	1. concrete aggregate 2. road base and coverings 3. asphaltic concrete 4. fill

Middle Atlantic states	1.	concrete aggregate
	2.	road base and coverings
	3.	asphaltic concrete
	4.	fill
South Atlantic states	1.	concrete aggregate
	2.	fill
	3.	asphaltic concrete
	4.	plaster and gunite sand
Gulf of Mexico states	1.	concrete aggregate
	2.	road base and coverings
	3.	fill
	4.	asphaltic concrete
Quebec	1.	road bed, surface
	2.	fill
	3.	other special uses
	4.	concrete aggregate
Ontario	1.	road bed, surface
	2.	concrete aggregate
	3.	fill
	4.	other special uses

Crushed stone exhibits similar variations. However, there is a much greater range of uses:

New England	1.	coarse bituminous aggregate
	2.	unpaved road surfacing
	3.	railroad ballast
	4.	bituminous mix, seal stone sand

Middle Atlantic states	1.	graded road base and subbase
	2.	coarse bituminous aggregate
	3.	coarse concrete aggregate
	4.	cement manufacture
South Atlantic states	1.	coarse concrete aggregate
	2.	graded road base and subbase
	3.	coase bituminous aggregate
	4.	cement manufacture
Gulf of Mexico states	1.	graded road base and subbase
	2.	coarse concrete aggregate
	3.	cement manufacture
	4.	lime manufacture
Ontario and Quebec	1.	road material
	2.	concrete aggregate
	3.	asphalt aggregate

The Ontario and Quebec figures are derived from data for all of Canada.

1.4 Price and Cost

Production costs for sand and gravel and crushed rock substantially from market to market and with aggregate use. For aggregate producers in Nova Scotia and New Brunswick, production costs are based upon information obtained from a survey of producers. For sand and gravel the production cost is approximately $3.50 per tonne and for crushed rock, $4.50 per tonne. These figures do not include transportation and handling costs.

For the various American markets, detailed cost data are available for each state and many aggregate uses. This information is presented in Tables 4.2 and 4.3.

In Quebec, the average production cost for sand and gravel is $1.83 per tonne and for crushed stone, $4.24. In Ontario the average production costs are: $2.91 per tonne for sand and gravel and $4.89 per tonne for crushed stone.

A general comparison of production costs for producers in New Brunswick and Nova Scotia and producers in the various export markets reveals that the latter have a decided advantage in their own market. The advantage is due to the high cost of transporting aggregates from New Brunswick and Nova Scotia to market. However, despite the general trend, the Maritime producers are competitive for some products in some markets.

Based upon selling price data alone, the most desirable cities for export are Toronto, New York, Houston, Mobile, Charleston, Dallas, and Savannah. Based upon the margin between selling price and production costs, New Brunswick and Nova Scotia producers could sell aggregates for profit in Toronto, Portland, Boston, and Hartford.

1.5 Transportation Findings

Aggregate materials are bulky, low-valued commodities and require large-scale transportation systems. Economies of scale in transporting aggregate to market require high volume contracts in the order, or in excess, of 500 000 tonnes per year. Yet, in many cases, the transport costs to external market exceed the aggregate product costs at the Maritime sources and may also exceed the purchase prices at the external markets.

Aggregates can be transported by truck, rail or marine modes. Intermodal activity are required between rail and truck and marine shiping and truck to transport the aggregate from producers to bulk handling facilities along rail lines and at ports.

Freight rates for bulk movement of aggregate materials include a complex collection of factors: length and minimum operating cost of haul; value and nature of commodity; annual volume, frequency and regularity of haul; transport equipment availability and capital depreciation, backhaul availability; loading and unloading requirements; intramodal and intermodal competition; length of contract; minimum load quantity or load factor; layover or berthing time charges; general economic market conditions.

The representative freight rates which were acquired for this analysis are marginally higher than negotiated contract rates; the latter are likely to be offered should a business offering materialize.

The costs of aggregate transport by trucks are very high in comparison to the value of the commodity; example transport costs are Yarmouth to Portland via the Bar Harbour ferry at $20.37 U.S. per tonne, and $20.07 Can. per tonne from Grand Falls to Quebec City.

The costs of aggregate transport by rail are also high in relation to the value of the commodity; example transport costs are $31.75 U.S. per tonne from Grand Falls to Boston, and $16.00 Can. per tonne from Grand Falls to Quebec City. These costs do not include additional costs for truck transfer from source to existing remote rail loading facilities or construction of the facilities at the site.

The costs of aggregate transport by marine ships include the costs from originating port to destination port plus, if necessary, the costs of trucking to the originating port from the source and the transhipment costs from the trucks to the ship. While marine shipping rates are considerably lower than the other modes, the transport costs are adversely affected as the distance from the aggregate sources to bulk handling ports increases.

No backhauls, at present, have been available for any of the modes. Availability of at least a partial backhaul to the trucking mode is apt to become available due to the flexibility of trucks in routing and handling different commodities.

1.6 Market Evaluation

The level of competition among sand and gravel producers varies from market area to market area. New England is characterized by a few medium and many small producers, while the Middle Atlantic and South Atlantic states have an even distribution of large, medium, and small producers. The Gulf of Mexico states, however, are dominated by very large and larger producers. In Quebec, only small producers operate, while Ontario has a mixture of large, medium and many small producers.

An evaluation of the competition yielded the following assessments:

Very high level of competition:	Pennsylvania Florida

High level of competition:
- Ontario
- New Hampshire
- Massachusetts
- Connecticut
- New York
- Mississippi

Medium level of competition:
- Quebec
- Maine
- Rhode Island
- New Jersey
- Delaware
- Maryland
- Virginia
- North Carolina
- South Carolina
- Georgia
- Alabama
- Louisiana
- Texas

Crushed stone operations tend to be larger than sand and gravel operations. New England, the Middle Atlantic states, and Ontario have an even distribution of large, medium, and small producers. The South Atlantic states are dominated by eleven very large and three large producers, as are the Gulf of Mexico states with five very large, six large, and five medium and small producers. Quebec is characterized by a large number of small producers.

An evaluation of the crushed stone competition reveals much less competition:

High level of competition:
Quebec
New York

Medium level of competition:
Ontario
Massachusetts
Virginia
Florida
Louisiana

Low or very low level of competition:
Maine
New Hampshre
Connecticut
New Jersey
Pennsylvania
Maryland
North Carolina
South Carolina
Georgia
Alabama
Mississippi
Texas

An analysis of producers' costs and assets reveals a similar pattern across the industry, in Canada and the United States.

There is no tariff imposed by the United States upon imports of Canadian aggregate.

1.7 Trends in Production and Consumption

Short-term trends in aggregate production have included a shift from sand and gravel to crushed stone. As well, South Atlantic and Gulf of Mexico states have a higher rate of growth in aggregate consumption than other American or Canadian markets.

There are a number of long-term trends which will either enhance or adversely affect aggregate markets for New Brunswick or Nova Scotia producers. On the supply side, the trends favour New Brunswick and Nova Scotia producers. Environmental pressures, environmental and safety legislation, land use conflicts, and a reduction in slag production all will make aggregates more difficult and more expensive to produce in export markets. On the demand side, there are a number of positive and negative trends. Negatively, consumption could be reduced as renovation increases at the expense of new construction, as soil cement use increases, and as recycling becomes more popular. Positively, consumption could be increased by the development of new, aggregate-based products and enhanced economies in export markets.

Overall, the long-term trends appear to favour New Brunswick and Nova Scotia producers. Thus, if they can secure a share under current market conditions, a Nova Scotia or New Brunswick producer should be able to maintain or increase that share in the future. However, all projections are contingent upon the maintenance of a low-valued Canadian dollar and low shipping costs.

2.0 POTENTIAL MARKETS

2.1 Introduction

The market area for this study was defined within the objective of this study. It called for "an in-depth study of the markets for aggregates materials accessible from Nova Scotia and New Brunswick." For the purposes of this study, accessibility was defined as access which is easy, cost-effective, and economically desirable.

Ease of access limits markets to locations which have facilities able to handle large volumes of aggregates. As a low value, bulk commodity, aggregate is profitable only if sold in large volumes. Thus, the study area was reduced to locations having large bulk handling ports, good railway service, or good roads.

Cost-effective locations are those which can be served at relatively low cost. As illustrated in Chapter 6.0, transportation costs can make aggregate prices prohibitive once a certain cutoff distance is reached. This distance, in turn, is dependent upon the mode of transport ranging from several hundred miles for ships to a few dozen miles for trucks.

An economically desirable market is one with a demand large enough to justify export. It has two dimensions: total demand (in turn a function of economic activity) and existing supply, a function of competition.

2.2 United States

Using the above criteria, the American market area was limited to nineteen states accessible by ship (see Table 2.1). In turn, the states were themselves reduced to those portions within

TABLE 2.1

AMERICAN STATES CONSIDERED ACCESSIBLE FROM NEW BRUNSWICK AND NOVA SCOTIA

State	Portion
Maine	southern half, especially Portland area
New Hampshire	coastal portion near Portsmouth
Massachusetts	eastern half, especially Boston area
Rhode Island	all
Connecticut	all
New York	New York City, lower Hudson River Valley, Long Island
New Jersey	all
Pennsylvania	east of Harrisburg, south of Allentown
Delaware	all
Maryland	all
Virginia	coastal portion from Washington, D.C. to Norfolk
North Carolina	Wilmington area
South Carolina	Charleston area
Georgia	coastal portion including Brunswick and Savannah
Florida	all, especially Jacksonville, Miami and Tampa areas
Alabama	Mobile area
Mississippi	Biloxi area
Louisiana	southern half, especially New Orleans area
Texas	coast portion, especially Galveston-Houston area

reasonable trucking distance from port. Thus large portions of Pennsylvania, New York, and Texas were not as viable markets. Further research confirmed this assessment.

2.3 Canada

Following the same procedure used for the American market, the Canadian market was reduced to two provinces--Quebec and Ontario*. In turn, the market area was reduced to the portions of the two provinces accessible by ship. In the case of Ontario, the market was further reduced to the portion east of the Niagara Peninsula.

2.4 Caribbean

Because of geography and market size, most Caribbean countries were considered marginal: the countries which are large (Cuba, Jamaica) have mountainous terrain and likely ample reserves, while those without reserves (Bahamas) are small. Further research has reinforced this assessment (see Table 2.2). Thus, for this study, little further research will be done on the Caribbean market.

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* The terms of reference for the study specifically asked the team to look at markets west of New Brunswick and Nova Scotia, thus Prince Edward Island and Newfoundland were not included.

TABLE 2.2

MARKET STATUS FOR AGGREGATES IN THE CARIBBEAN

Country	Status
Barbados	Self-sufficient for next five years and more
Trinidad and Tobago	Self-sufficient, wide range of aggregates, "very long term" reserves
Antigua and Barbuda Dominica Grenada Montserrat St. Kitts-Nevis Saint-Lucia St. Vincent and the Grenadines	All seven of these states are represented through the Organization of Eastern Caribbean States. There is no current need for aggregate imports. Antigua and Barbuda exported sand and gravel to the United States from 1981 to 1983. 1981 - 51 000 tonnes worth $812 000 (US) 1982 - 15 000 tonnes worth $210 000 1983 - 1 000 tonnes worth $ 11 000
Bahamas	No response as yet. Has imported and exported sand and gravel from and to the United States. Imports: 1980 - 5 500 tonnes worth $ 46 000 (US) 1981 - 21 000 tonnes worth $114 000 1982 - 29 000 tonnes worth $162 000 1983 - 21 000 tonnes worth $124 000 Over 90 percent of this material is gravel. Exports: 1980 - none 1981 - none 1982 - 9 000 tonnes worth ($32 000 (US) 1983 - 9 000 tonnes worth $32 000 Has also imported and exported crushed stone from and to the United States. Imports:

TABLE 2.2 (continued)
MARKET STATUS FOR AGGREGATES IN THE CARIBBEAN

Country	Status
Bahamas (cont'd)	1980 - 57 000 tonnes 1981 - 12 000 tonnes 1982 - none 1983 - none Exports: 1980 - 260 000 tonnes worth $332 000 (US) est. 1981 - 243 000 tonnes worth $370 000 1982 - 173 000 tonnes worth $860 000 est. 1983 - 370 000 tonnes worth $900 000 est. The material is calcium carbonate fines (chalk).
Dominican Republic	In 1981, it imported sand from the United States valued at $18 000 (US).
Haiti	No response
Cuba	No response
Jamaica	No response

3.0 PRODUCT CONSIDERATIONS

3.1 Introduction

Crushed stone and sand and gravel are used for many applications. Presented in Table 3.1 are the most commonly used categories as defined by the United States Bureau of Mines and Minerals.

It is difficult for an aggregate supplier to export material for all uses because of the varying quantities and specifications required. A more efficient approach is to supply large volumes of aggregates which meet the specifications of the most commonly used categories. In addition, a supplier will find market entry considerably easier when competing for a small share of a large market segment than for a large share of a small market segment.

Using the above approach, each market was analyzed to determine what types of aggregate would be most suitable for export. The procedure used was as follows:

(a) For each market (state or province) the top uses and their volumes were determined. Uses were not listed unless they reported 5 percent or more of the market volume.

(b) The submarket results were tabulated and then summarized to determine the most common uses for each market.

3.2 Sand and Gravel

3.2.1 United States

The results of the use analysis are listed in Table 3.2. Presented below are the most common uses for sand and gravel. As can be seen, they remain the same for most markets. Of the five uses listed, three are relatively high valued products

TABLE 3.1 - USES FOR SAND AND GRAVEL AND CRUSHED STONE (AS DEFINED BY THE U.S. BUREAU OF MINES AND MINERALS)

Product	Uses
Sand and gravel	Concrete aggregate
	Concrete products
	Asphaltic concrete
	Plaster and gunite sands
	Road base and coverings
	Railroad ballast
	Fill
	Snow and ice control
Crushed stone	Coarse aggregate (over 1.5 inch)
	- macadam
	- riprap and jetty stone
	- filter stone
	- other
	Coase aggregate, graded
	- concrete aggregate, coarse
	- bituminous aggregate, coarse
	- bituminous surface-treatment aggregate
	- railroad ballast
	- other
	Fine aggregate (under 0.375 inch)
	- concrete stone sand
	- bituminous mix or seal stone sand
	- undesignated screening
	Coarse and fine aggregate
	- graded road base and subbase
	- unpaved road surfacing
	- terrazzo and exposed aggregate
	- crush run or fill or waste
	- other coarse and fine aggregate
	Agricultural
	- agricultural limestone
	- poultry grit and mineral food
	- other

TABLE 3.1 (continued)

Product	Uses
	Chemical and metallurgical
	- cement manufacture
	- lime manufacture
	- ferrosilicon
	- flux stone
	- glass manufacture
	- sulfur oxide removal
	Special
	- mine dusting or acid water treatment
	- asphalt fillers or extenders
	- other fillers or extenders
	- roofing granules
	- other

TABLE 3.2 - USES FOR SAND AND GRAVEL
PRODUCED IN THE UNITED STATES, 1982
(M TONS)

Market	State	Concrete Aggregate	Concrete Products	Asphaltic Concrete	Plaster and Gunite Sands	Road Base and Coverings	Railroad Ballast	Fill	Snow and Ice Control	Total (including other uses)
New England	Maine	1.01	--	1.69	—	1.83	--	1.02	0.73	6.70
	New Hampshire	1.42	—	0.90	--	1.11	--	0.33	0.24	4.33
	Massachusetts	5.05	0.78	1.03	--	2.09	—	1.80	0.73	12.00
	Rhode Island	--	--	0.12	--	0.23	—	0.28	—	1.15
	Connecticut	1.68	--	0.61	--	1.19	—	0.63	0.31	4.92
	SUBTOTAL	9.16	0.78	4.35	--	6.45	--	4.06	2.01	29.10
Middle Atlantic	New York	4.19	—	2.70	—	5.04	--	2.80	1.37	17.52
	New Jersey	2.77	0.47	1.24	0.76	0.95	--	1.40	--	7.94
	Pennsylvania	4.56	1.11	2.41	--	3.35	—	0.89	--	13.08
	Delaware	0.34	--	--	--	0.75	--	--	--	1.30
	Maryland	4.77	1.02	1.73	--	0.88	—	0.84	--	9.72
	Virginia	3.11	1.35	0.41	--	0.72	--	1.03	—	6.98
	SUBTOTAL	19.74	3.95	8.49	0.76	11.69	--	6.96	—	66.54
South Atlantic	North Carolina	2.86	--	0.99	--	0.47	--	0.48	—	5.20
	South Carolina	2.35	0.36	0.93	--	--	--	0.84	--	4.73
	Georgia	2.45	--	--	--	0.26	--	--	--	3.17
	Florida	7.20	—	--	0.76	--	--	4.70	--	13.75
	SUBTOTAL	14.86	0.36	1.92	0.76	0.73	--	6.02	—	26.85
Gulf of Mexico	Alabama	3.99	0.37	1.03	--	0.95	--	0.65	--	7.02
	Mississippi	3.32	--	2.94	--	2.29	--	0.51	--	9.46
	Lousiana	10.03	1.04	1.74	--	2.00	—	1.67	--	16.56
	Texas	32.59	--	--	--	3.11	--	5.36	--	45.53
	SUBTOTAL	49.93	1.41	5.71	--	8.35	--	8.19	--	78.57

(concrete aggregate, asphaltic concrete, and plaster and gunite sands) while the other two are relatively low valued products (fill and road base and coverings).

New England	1.	concrete aggregate
	2.	road base and coverings
	3.	asphaltic concrete
	4.	fill
Middle Atlantic	1.	concrete aggregate
	2.	road base and coverings
	3.	asphaltic concrete
	4.	fill
South Atlantic	1.	concrete aggregate
	2.	fill
	3.	asphaltic concrete
	4.	plaster and gunite sands
Gulf of Mexico	1.	concrete aggregate
	2.	road base and coverings
	3.	fill
	4.	asphaltic concrete

3.2.2 Quebec and Ontario

Although the use categories used in Canada are somewhat different, they are similar enough to those used in the United States to allow comparison (Table 3.3). Similar to the United States three large end uses are concrete aggregate, road bed, and fill plus another category--other special uses.

TABLE 3.3 - USES FOR SAND AND GRAVEL
PRODUCED IN QUEBEC, 1982 (M TONNES)
(ENERGY, MINES, AND RESOURCES, CANADA)

Market	Concrete Aggregate	Mortar Sand	Road Bed, Surface	Railroad Ballast	Fill	Asphalt Aggregate	Backfill for Mines	Other Special Uses	Total*
Quebec	3.04	0.31	26.43	0.15	7.72	3.46	0.60	0.22	41.93
Ontario	9.27	0.87	36.29	0.78	7.29	4.02	0.56	1.31	60.37

*Totals may not equal sum of uses due to rounding.

Quebec

1. road bed, surface
2. fill
3. other special uses
4. concrete aggregate.

Ontario

1. road bed, surface
2. concrete aggregate
3. fill
4. other special uses

3.3 Crushed Stone Demand

3.3.1 United States

In comparison to sand and gravel, crushed stone has a greater variety in popular uses (see Table 3.4). However, several are common to most markets:

New England

1. coarse bituminous aggregate
2. unpaved road surfacing
3. railroad ballast
4. bituminous mix, seal stone sand

Middle Atlantic

1. graded road base and subbase
2. coarse bituminous aggregate
3. coarse concrete aggregate
4. cement manufacture

South Atlantic

1. coarse concrete aggregate
2. graded road base and subbase
3. coarse bituminous aggregate
4. cement manufacture

TABLE 3.4 - USES FOR CRUSHED ROCK PRODUCED IN THE UNITED STATES, 1983 (M TONS)

Market	State	Macadam	Riprap and Jetty Stone	Filter Stone	Coarse Concrete Aggregate	Coarse Bituminous Aggregate	Bituminous Surface Treatment Aggregate	Railroad Ballast	Concrete Stone Sand	Bituminous Mix/Seal Stone Sand	Graded Road Base and Subbase	Unpaved Road Surfacing	Terrazzo and Exposed Aggregate
New England	Maine	--	--	--	--	--	--	--	--	--	--	--	--
	New Hampshire	--	--	--	--	--	--	--	--	--	--	--	--
	Massachusetts	--	0.51	--	--	1.83	--	0.79	--	0.54	0.56	0.91	--
	Rhode Island	--	--	0.09	--	0.08	--	--	--	0.06	--	--	--
	Connecticut	--	--	--	--	0.47	--	--	--	--	--	--	--
	SUBTOTAL	--	0.51	0.09	--	1.38	--	0.79	--	0.60	0.56	0.91	--
Middle Atlantic	New York	--	--	--	2.09	4.45	--	--	--	--	4.58	--	--
	New Jersey	--	--	--	1.80	1.40	--	--	--	--	1.80	--	--
	Pennsylvania	--	--	--	3.51	3.61	--	--	--	--	6.70	7.00	--
	Delaware	--	--	--	--	--	--	--	--	--	--	--	--
	Maryland	1.93	--	--	2.92	2.21	--	--	--	--	1.83	4.17	--
	Virginia	--	--	--	4.60	4.09	2.14	--	--	--	8.33	--	--
	SUBTOTAL	1.93	--	--	14.92	15.76	2.14	--	--	--	22.26	11.17	--
South Atlantic	North Carolina	--	--	--	5.74	4.68	--	--	--	--	--	--	--
	South Carolina	--	--	--	2.28	--	--	--	--	--	--	--	--
	Georgia	--	--	--	6.86	4.69	--	3.33	2.05	--	9.46	--	--
	Florida	--	--	--	15.78	--	--	--	3.52	--	12.77	--	--
	SUBTOTAL	--	--	--	30.66	9.37	--	3.33	5.57	--	22.23	--	--
Gulf of Mexico	Alabama	--	--	--	3.33	1.58	--	--	--	--	2.37	--	--
	Mississippi	--	--	--	--	--	--	--	--	--	--	--	--
	Lousiana	--	--	--	--	--	--	--	--	--	2.82	1.28	--
	Texas	--	--	--	11.58		--	--	--	--	23.36		--
	SUBTOTAL	--	--	--	14.91	1.58	--	--	--	--	28.55	1.28	--

TABLE 3.4 (continued)

Market	State	Agricultural Limestone	Poultry Grit and Mineral Food	Cement Manufacture	Lime Manufacture	Ferrosilicon	Flux Stone	Sulfur Oxide Removal	Mine Dusting or Acid Water Treatment	Asphalt Fillers or Extenders	Roofing Granules			Total
New England	Maine	--	--	--	--	--	--	--	--	--	--			0.85
	New Hampshire	--	--	--	--	--	--	--	--	--	--	--	--	0.95
	Massachusetts	--	--	--	--	--	--	--	--	--	--	--	--	7.74
	Rhode Island	--	--	--	--	--	--	--	--	--	--	--	--	0.97
	Connecticut	--	--	--	--	--	--	--	--	--	--	--	--	7.70
	SUBTOTAL	--	--	--	--	--	--	--	--	--	--	--	--	18.21
Middle Atlantic	New York	--	--	--	--	--	--	--	--	--	--	--	--	32.34
	New Jersey	--	--	--	--	--	--	--	--	--	--	--	--	12.30
	Pennsylvania	--	--	5.88	--	--	--	--	--	--	--	--	--	51.52
	Delaware	--	--	--	--	--	--	--	--	--	--	--	--	0.00
	Maryland	--	--	2.28		--	--	--	--	--	--	--	--	19.28
	Virginia	--	--	--	--	--	--	--	--	--	--	--	--	37.96
	SUBTOTAL	--	--	8.16		--	--	--	--	--	--	--	--	153.40
South Atlantic	North Carolina	--	--	--	--	--	--	--	--	--	--	--	--	33.69
	South Carolina	--	--	2.84	--	--	--	--	--	--	--	--	--	15.79
	Georgia	--	--	--	--	--	--	--	--	--	--	--	--	41.10
	Florida	--	--	3.66	--	--	--	--	--	--	--	--	--	57.28
	SUBTOTAL	--	--	6.50	--	--	--	--	--	--	--	--	--	147.86
Gulf of Mexico	Alabama	--	--	3.82	1.82	--	--	--	--	--	--	--	--	20.56
	Mississippi	--	--	--	--	--	--	--	--	--	--	--	--	1.90
	Lousiana	--	--	--	--	--	--	--	--	--	--	--	--	5.75
	Texas	--	--	9.53	--	--	--	--	--	--	--		--	76.45
	SUBTOTAL	--	--	13.35	1.82	--	--	--	--	--	--	-	--	104.67

Gulf of Mexico

1. graded road base and subbase
2. coarse concrete aggregate
3. cement manufacture
4. lime manufacture

The values for the eight uses listed above tend to be low or medium value, the only exceptions being the high valued uses of lime and cement manufacture.

3.3.2 Canada

Unfortunately, detailed information on crushed rock use is not available for Quebe and Ontario. Presented in Table 3.5 is information for the entire nation. It is assumed that use in Quebec and Ontario reflects this pattern.

Quebec and Ontario

1. road material
2. concrete aggregate
3. asphalt aggregate

TABLE 3.5 - USES FOR CRUSHED STONE PRODUCED IN CANADA, 1982 (ENERGY, MINES AND RESOURCES CANADA)

	Use	Canada M tonnes	%
Crushed:	Concrete aggregate	4.21	7.9
	Asphalt aggregate	4.09	7.7
	Road material	16.21	30.6
	Railway ballast	2.36	4.4
	Rubble and riprap	1.56	2.9
	Roofing granules	0.23	0.4
	Poultry grit	0.03	0.1
	Stucco dash	0.01	-
	Other uses (incl. artificial stone manufacture, terrazzo, etc.	20.24	38.2
	Total*	48.95	92.3
Chemical and metallurgical:			
	Cement plants, foreign	0.54	1.0
	Furnace lining	0.03	0.1
	Flux	0.77	1.5
	Glass factories	0.15	0.3
	Lime kilns, foreign	0.46	0.9
	Pulp and paper	0.27	0.5
	Sugar refineries	0.10	0.2
	Other	0.12	0.2
	Total*	2.44	4.6
Pulverized:	Agricultural uses	0.93	1.8
	Whiting	0.06	0.1
	Asphalt filler	0.04	0.1
	Other uses incl. coal mine dusting	0.63	1.2
	Total*	1.66	3.1
	Grand total*	53.05	100.0

*Totals may not equal sum of parts due to rounding

4.0 PRICES AND COSTS

4.1 Introduction

As businessmen, aggregate producers want to maximize gross profit on sales. Gross profit is a function of unit margin between price and cost and the volume of product sold. (Volume is discussed under Product Considerations).

Three elements were investigated in the analysis of margin: product cost for New Brunswick and Nova Scotia producers, product costs for existing producers in export markets, and selling price.

Product cost for New Brunswick and Nova Scotia producers was determined because it represents the base figure which the producers must watch to stay in business. Product cost for existing producers in export markets was determined because it represents the base figure for competing firms and the limit to which they can lower prices in a long term price competition.

Price was analyzed because it represents the current market value for aggregate products and is the unit return a New Brunswick or Nova Scotia producer will get for his aggregate, regadless of his costs.

4.2 Product Costs - New Brunswick and Nova Scotia Producers

4.2.1 Sand and Gravel

To determine these values, many of the producers in New Brunswick and Nova Scotia were polled for information. Although there is variation in product cost among the various New

Brunswick and Nova Scotia producers, it is assumed that most experience an on-site production cost of $3.00 per tonne, regardless of product. In order to export, the producer will incur additional costs such as transportation and handling (discussed elsewhere), storage, marketing, plus markup. For the purposes of this analysis, the producer cost is assumed to be $3.50 per tonne plus transportation and handling from the lowest cost points of origin in New Brunswick (Brookville) and Nova Scotia (Mulgrave) (see Table 5.11). The producer costs are presented in Table 4.1.

4.2.2 Crushed Stone

United States, Quebec and Ontario. Because of the greater inputs required to produce crushed stone, its product cost tends to be higher. For this analysis, an on-site product cost of $4.00 per tonne was used for all products. To account for additional exporting costs, a production cost of $4.50 plus transportation and handling was assumed for export. Once again, the lowest cost origin points of Brookville and Mulgrave were used to determine exact costs at destinations (see Table 5.11). The producer costs are presented in Table 4.1.

4.3 Product Costs - Existing Producers in Export Markets

4.3.1 Sand and Gravel

United States. Unit values for various sand and gravel end uses are presented in the market summaries presented in Appendix A. These values are not costs in the strict sense of the word, as they represent prices for which producers sell their product at the plant, and can include some profit. However, for the purposes of this study, they are treated similar to the costs developed for New Brunswick and Nova Scotia producers. They

TABLE 4.1

PRODUCT COST FOR AGGREGATES PRODUCED IN NOVA SCOTIA AND NEW BRUNSWICK FOR SALE TO THE UNITED STATES, QUEBEC AND ONTARIO (CANADIAN DOLLARS PER TONNE)

Destination	Sand and Gravel		Crushed Stone	
	Saint John (Brookville)	Mulgrave	Saint John (Brookville)	Mulgrave
Boston	$12.68	$12.03	$13.68	$13.03
New York	13.42	12.77	14.42	13.77
Philadelphia	13.86	13.22	14.86	14.22
Baltimore	14.76	14.12	15.76	15.12
Hampton (Virginia)	14.31	13.66	15.31	14.66
Wilmington (North Carolina)	15.21	14.57	16.21	15.57
Savannah (Georgia)	15.96	15.31	16.96	16.31
Miami	16.40	15.75	17.40	16.75
Houston	20.28	19.64	21.28	20.64
Quebec	15.23	7.80	16.23	8.80
Montreal	15.98	8.55	16.98	9.55
Toronto	19.13	11.70	20.13	12.70

were converted from American dollars (1982) per ton to Canadian dollars (1985) per tonne by assuming an American dollar equalled $1.33 Canadian--5 percent inflation and 1 ton equalled 0.909 tonne (see Table 4.2). (Inflation was factored into the values, for even though aggregate prices has remained steady through the 1980s, costs have tended to rise.)

As a preliminary screen of low value aggregate products, unit values below $4.00 were not included in Table 4.2. They do not include transportation and handling costs for transporting the aggregate from the source to the consumer.

Quebec and Ontario. Unfortunately, detailed product costs are not available for either province. Average unit values are known.

$1.58/tonne for Quebec in 1982
$2.51/tonne in Ontario in 1982

These values were converted to 1985 dollars using 5 percent inflation, yielding:

$1.83/tonne in Quebec
$2.91/tonne in Ontario

They do not include transportation and handling costs for transorting the aggregate from the source to the consumer.

Crushed Stone

United States. The treatment here was similar to that for sand and gravel (see Table 4.3). As a preliminary screen of low value end uses, unit values below $4.00 were not included in Table 4.3. As before, the prices do not include transportation and handling costs.

Canada. As for sand and gravel, there is no information available on unit costs for crushed stone products. Average unit values are:

TABLE 4.2 - PRODUCT COST FOR SAND AND GRAVEL PRODUCTS PRODUCED IN THE UNITED STATES (CANADIAN DOLLARS PER TONNE)

Market	State	Concrete Aggregate	Concrete Products	Asphaltic Concrete	Plaster and Gunite Sands	Road Base and Coverings	Railroad Ballast	Fill	Snow and Ice Control	Average (including other uses)
New England	Maine	5.40	5.08	4.70	--	--	7.46	--	--	3.95
	New Hampshire	5.74	5.40	5.52	5.29	4.88	--	--	--	5.08
	Massachusetts	6.12	4.72	5.57	7.16	--	--	--	--	5.02
	Rhode Island	5.06	7.87	4.47	8.02	5.26	--	--	6.36	5.59
	Connecticut	6.72	6.21	6.44	9.72	4.72	--	--	5.50	5.82
Middle Atlantic	New York	6.18	5.18	6.04	6.62	--	5.82	--	--	4.77
	New Jersey	6.45	5.91	4.99	6.01	5.15	--	4.47	6.46	5.67
	Pennsylvania	7.91	8.65	9.09	9.14	5.89	6.12	--	6.71	7.40
	Delaware	4.76	5.68	5.47	6.44	--	--	--	--	4.30
	Maryland	6.30	5.61	5.26	--	5.02	--	4.63	--	5.82
	Virginia	7.63	9.39	5.45	6.03	7.44	--	--	4.39	7.15
South Atlantic	North Carolina	5.54	5.23	5.44	5.40	4.61	--	--	7.04	5.17
	South Carolina	5.14	6.18	6.56	--	--	--	--	--	4.87
	Georgia	4.73	4.84	--	--	4.84	--	--	--	4.61
	Florida	4.37	4.42	9.44	5.82	--	--	--	--	3.87
Gulf of Mexico	Alabama	--	5.17	4.52	--	--	--	--	6.06	4.28
	Mississippi	4.91	--	5.77	--	4.82	--	--	--	4.99
	Louisiana	5.36	5.65	8.54	7.10	4.61	--	--	--	5.37
	Texas	6.31	5.86	6.53	6.45	6.28	4.90	--	--	5.92

TABLE 4.3

PRODUCT COST FOR CRUSHED STONE PRODUCTS
PRODUCED IN THE UNITED STATES
(CANADIAN DOLLARS PER TONNE)

Market	State	Macadam	Riprap and Jetty Stone	Filter Stone	Coarse Concrete Aggregate	Coarse Bituminous Aggregate	Bituminous Surface Treatment Aggregate	Railroad Ballast	Concrete Stone Sand	Bituminous Mix/Seal Stone Sand	Graded Road Base and Subbase	Unpaved Road Surfacing	Terrazzo and Exposed Aggregate
New England	Maine	--	--	--	--	--	--	--	--	--	--	--	--
	New Hampshire	--	--	--	--	--	--	--	--	--	--	--	--
	Massachusetts	--	6.24	7.16	5.24	7.82	--	5.78	--	6.94	6.79	6.03	--
	Rhode Island	--	--	--	--	--	--	--	--	--	--	--	--
	Connecticut	--	--	--	7.01	6.91	--	--	--	--	--	--	--
Middle Atlantic	New York	9.22	7.81	5.81	6.16	9.59	12.25	6.89	7.21	6.95	7.06	7.54	--
	New Jersey	--	--	--	8.01	8.29	9.50	8.70	4.81	--	8.80	9.05	--
	Pennsylvania	5.98	7.27	6.42	6.70	6.78	6.47	5.92	6.97	8.40	6.09	5.94	--
	Delaware	--	--	--	--	--	--	--	--	--	--	--	--
	Maryland	5.13	7.47	--	5.65	6.81	6.97	5.71	10.81	5.63	7.15	7.57	--
	Virginia	5.08	8.65	5.50	7.26	7.19	7.34	5.61	7.22	5.29	6.40	6.42	9.98
South Atlantic	North Carolina	5.57	9.13	9.53	7.65	7.46	8.56	6.36	6.17	--	6.79	7.16	--
	South Carolina	7.16	--	--	7.01	--	6.92	7.64	--	--	--	--	--
	Georgia	--	8.10	--	7.92	7.18	7.95	6.37	6.97	6.85	6.58	7.23	--
	Florida	--	7.01	10.14	7.50	8.36	--	9.16	7.44	9.05	4.29	--	--
Gulf of Mexico	Alabama	--	5.96	6.95	6.39	6.27	7.06	--	6.60	--	5.71	7.46	--
	Mississippi	--	--	--	--	--	--	--	--	--	--	--	--
	Louisiana	--	--	--	--	--	--	--	--	--	7.81	5.29	--
	Texas	--	7.13	6.55	5.60	6.18	8.04	5.30	5.87	5.47	--	4.84	8.12

TABLE 4.3 (continued)

Market	State	Agricultural Limestone	Poultry Grit and Mineral Food	Cement Manufacture	Lime Manufacture	Ferrosilicon	Flux Stone	Sulfur Oxide Removal	Mine Dusting or Acid Water Treatment	Asphalt Fillers or Extenders	Roofing Granules	Whiting or Whiting Substitute		Average	
New England	Maine	--	--	--	--	--	--	--	--	--	--	--	--	5.39	
	New Hampshire	--	--	--	--	--	--	--	--	--	--	--	--	5.14	
	Massachusetts	25.70	--	--	25.07	--	--	--	--	--	--	--	--	7.51	
	Rhode Island	--	--	--	--	--	--	--	--	--	--	--	--	9.16	
	Connecticut	--	--	--	--	--	--	--	--	--	--	--	--	10.00	
Middle Atlantic	New York	13.86	--	--	--	--	--	--	--	--	--	--	--	6.91	
	New Jersey	--	--	--	--	--	--	--	--	--	--	--	--	9.25	
	Pennsylvania	12.69	20.68	5.64	9.36	--	9.77	--	30.31	17.24	--	--	--	7.12	
	Delaware	--	--	--	--	--	--	--	--	--	--	--	--		
	Maryland	--	--	--	6.12	--	--	--	--	--	--	--	--	6.74	
	Virginia	12.60	--	--	9.70	--	4.82	--	13.07	--	--	--	--	6.75	
South Atlantic	North Carolina	--	17.25	--	--	--	--	--	--	--	--	--	--	6.99	
	South Carolina	--	--	--	--	--	--	--	--	--	--	--	--	6.29	
	Georgia	--	--	--	--	--	--	--	--	--	--	--	--	7.33	
	Florida	8.53	4.64	6.89	--	--	--	--	--	--	--	--	--	6.64	
Gulf of Mexico	Alabama	7.67	--	8.44	6.16	--	8.17	--	--	--	5.81	26.62	--	7.50	
	Mississippi	--	--	--	--	--	--	--	--	--	--	--	--	4.77	
	Lousiana	--	--	4.37	--	--	--	--	--	--	--	--	--	7.22	
	Texas	--	--	9.02	--	--	--	--	--	--	25.29	--	--	5.06	

$3.66 in Quebec in 1982
$4.22 in Ontario in 1982

Converting to 1985 dollars yields:
$4.24 in Quebec
$4.89 in Ontario

As before, the prices do not include transportation and handling costs.

4.4 Comparison of Product Costs

A comparison of product costs for New Brunswick and Nova Scotia producers to those for existing competitors in export markets reveals a decided disadvantage for the Maritime poducers for most aggregate products. The culprit is the high transportation and handling cost component--if it could be ignored the Maritime producer costs would be equal or less than most existing competitors.

With transportation and handling costs included, New Brunswick producers have cost advantages for these products in the following markets:

Sand and gravel:

None.

Crushed stone:

Agricultural limestone - Massachusetts, New York
Poultry grit and mineral food - Pennsylvania, North Carolina
Lime manufacture - Massachusetts

Mine dusting or acidic water treatment - Pennsylvania
Asphalt fillers or extenders - Pennsylvania
Roofing granules - Texas
Whiting or whiting substitute - Alabama

For Nova Scotia producers:

Sand and gravel:

None.

Crushed stone:

Agricultural limestone - Massachusetts, New York

Poultry grit and mineral food - Pennsylvania, North Carolina
Lime manufacture - Massachusetts
Mine dusting or water treatment - Pennsylvania
Asphalt fillers or extenders - Pennsylvania
Roofing granules - Texas
Whiting or whiting substitute - Alabama

Most of the above products are specialty uses which have small market segments, higher processing requirements, and relatively stringent specifications. It would be difficult for a New Brunswick or Nova Scotia producer to develop and maintain markets for specialty uses.

4.5 Price in Export Markets

4.5.1 United States

Prices were obtained from two sources:

1. Means Site Work Cost Data catalogue (see Tables 4.4 and 4.5). Information was obtained for cities but not for states.

2. The Engineering-News Record monthly summary of materials prices for twenty North American cities (see Table 4.6). These were considered to be the most accurate figures.

A comparison of values from the two tables reveals some differences. They are created by several factors including different treatment of transportation costs and different materials description. In general, however, the values are in agreement.

Based upon the price tables, the most desirable cities for aggregate marketing are: New York, Houston, Mobile, Charleston, Dallas, and Savannah. The highest priced aggregate products are: crushed stone, riprap and sand, all for site work use.

4.5.2 Quebec and Ontario

Prices were obtained using the same sources used for American cities. This data reveals that Montreal has relatively low aggregate prices while Toronto has high prices for gravel and sand.

TABLE 4.4
CITY COST INDICES FOR CITIES IN THE UNITED STATES, QUEBEC AND ONTARIO

("Means Site Work Cost Data, 1985")

		INDEX FOR MATERIAL	
STATE/PROVINCE	CITY	SITE WORK	CAST IN PLACE CEMENT
Maine	Portland	95.9	92.4
New Hampshire	Manchester	91.9	93.3
Massachusetts	Boston	102.2	107.6
Rhode Island	Providence	81.5	87.8
Connecticut	Hartford	97.8	98.6
New York	New York	122.9	143.9
New Jersey	Newark	103.6	100.1
Pennsylvania	Philadelphia	103.8	94.6
Delaware	Wilmington	111.7	99.3
Maryland	Baltimore	95.1	109.4
Virginia	Norfolk	107.5	113.4
North Carolina	Raleigh	93.7	91.9
South Carolina	Charleston	118.2	100.9
Georgia	Savannah	114.3	95.1
	Atlanta	88.1	82.5
Florida	Miami	93.5	88.9
	Tampa	106.9	99.4
Alabama	Mobile	118.6	100.1
	Birmingham	97.2	92.1
Mississippi	Jackson	98.1	97.1
Louisiana	New Orleans	108.7	104.8
Texas	Houston	121.3	113.4
	Dallas	115.8	101.6
Quebec	Montreal	91.0	120.2
Ontario	Toronto	105.1	159.7

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* Base index value of 100 is for January 1, 1985 and is derived from an average for 30 major cities. Indices for individual cities represent cost variations above or below the base index.

TABLE 4.5

PRICES FOR AGGREGATE PRODUCTS IN CITIES IN THE UNITED STATES (CANADIAN DOLLARS PER TONNE)

	Site Work (Roads and Walks)		Cast in Place Concrete		
City	Riprap	Gravel (Bank Run)	Sand and Stone	Sand (Washed)	Stone (0.75 to 1.5 inch)
Base Data	16.50	12.02	5.35	9.60	10.48
Portland	15.83	11.53	4.94	9.21	10.07
Manchester	15.17	11.06	4.98	8.97	9.78
Boston	16.86	12.29	5.47	9.81	10.71
Providence	13.45	9.80	4.70	8.44	9.21
Hartford	16.14	11.76	5.28	9.47	10.34
New York	20.28	14.78	6.59	11.80	12.89
Newark	17.02	12.46	5.36	9.63	10.49
Philadelphia	17.13	12.49	5.06	9.08	9.91
Wilmington	18.44	13.43	5.30	9.54	10.41
Baltimore	15.70	11.44	5.85	9.14	9.98
Norfolk	17.73	12.94	5.07	10.90	11.89
Raleigh	15.46	11.26	4.92	8.83	9.64
Charleston	19.50	14.21	5.40	9.69	10.57
Savannah	18.86	13.74	5.09	9.14	9.98
Atlanta	14.53	10.60	4.41	7.92	8.66
Miami	15.43	11.25	4.75	8.54	9.33
Tampa	17.64	12.86	5.32	9.55	10.43
Mobile	19.57	14.27	5.35	9.62	10.50
Birmingham	16.04	11.69	4.93	8.84	9.67
Jackson	14.73	11.79	5.25	9.43	10.28
New Orleans	17.94	13.07	5.62	10.06	10.99
Houston	20.02	14.59	6.07	10.90	11.89
Dallas	19.11	13.93	5.44	9.75	10.65
Montreal	15.01	10.94	6.43	11.54	12.60
Toronto	17.34	16.04	8.54	15.33	16.74

TABLE 4.6

PRICES OF AGGREGATE PRODUCTS IN CITIES IN THE UNITED STATES, QUEBEC AND ONTARIO SEPTEMBER 1985 (CANADIAN DOLLARS, F.O.B. CITY)

(Source: Engineering-News Record)

CITY	GRAVEL 0.75 INCH	 1.5 INCH	SAND	CRUSHED STONE 0.75 INCH	 1.5 INCH
Boston	$12.47	$12.47	$11.00	$13.20[+]	$12.47[+]
New York	5.13[*]	-	3.67[*]	12.69	12.69
Philadelphia	11.51[o]	-	8.58[o]	12.91	12.91
Atlanta	11.88[x]	14.37[x]	16.87[x]	-	-
Birmingham	6.89[·]	6.67[·]	10.27	10.27[·]	10.27[·]
Dallas	14.11	12.98	9.42	16.06	14.56
Montreal	7.26[-]	6.94[-]	12.54	7.26[-]	6.94[-]
Toronto	16.06	16.06	12.54	9.61[p]	9.61[p]

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[*] 60 pounds per bag

[o] f.o.b. Morrisville, PA, 1% discount per ton

[+] 2% discount, 10 days

[x] crushed granite, delivered

[·] net

[-] plus 9 percent extra

[p] pit price

4.6 Potential Price Margins for New Brunswick and Nova Scotia Producers

4.6.1 United States

Once a supplier obtains a price which covers costs for aggregate, he then aims for a price which offers the greatest over costs.

Margins were determined for five aggregate users: gravel (0.75 and 1.5 inch), sand and crushed stone (0.75 and 1.5 inch) using the procedure below:

1. Values for New Brunswick and Nova Scotia producers were obtained from Table 4.1. As before, the prices were assumed to apply to all sand and gravel and crushed stone products.

2. Prices for cities were obtained from Table 4.6 as the Engineering News Record prices are considered to be the most accurate.

3. Because of data limitations, it was assumed that cities within the same state would have the same selling price. This is a best case assumption ignoring the cost of additional trucking from the port city to the reference city. The results are presented in Table 4.7.

Because of the many assumptions underlying the margin calculations, the results should be considered as relative rather than aboslute. However, the results reinforce the conclusions regarding transportation and handling costs, as the greater the distance to market the lower the margin. The only anomaly in Table 4.7 is the set of results for Atlantic, however, they do

TABLE 4.7

POTENTIAL PRICE MARGINS FOR NEW BRUNSWICK AND NOVA SCOTIA PRODUCERS
(CANADIAN DOLLARS PER TONNE)

City	Saint John (Brookville)					Mulgrave				
	Gravel		Sand	Crushed Stone		Gravel		Sand	Crushed Stone	
	0.75 inch	1.5 inch		0.75 inch	1.5 inch	0.75 inch	1.5 inch		0.75 inch	1.5 inch
Boston	NM	NM	NM	NM	NM	$0.44	$0.44	NM	$0.17	NM
New York	-	-	-	NM	NM	-	-	-	NM	NM
Philadelphia	NM	-	NM	NM	NM	NM	-	NM	NM	NM
Atlanta*	NM	NM	NM	-	-	NM	NM	1.56	-	-
Birmingham°	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Dallas+	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM
Montreal	NM	NM	NM	NM	NM	NM	NM	0.20	NM	NM
Toronto	NM	NM	NM	NM	NM	2.52	2.52	NM	NM	NM

*	Matched to Savannah
•	Matched to Miami
+	Matched to Houston
NM	No or negative margin

not reflect the additional cost of trucking aggregate from Savannah to Atlanta. That expense would likely eliminate any margin.

As can be seen from the results, the current cost-price situation limits exports to shipments from Mulgrave to the New England market; specifically Boston and likely Portland and Hartford.

4.6.2 Canada

Price margins were determined using the same procedure as for American markets.

Analysis of the results shows that the current cost-price selection limits exports to shipments from Mulgrave to Montreal (sand) and Toronto (0.75 and 1.5 inch gravel).

5.0 TRANSPORTATION OF MINERAL AGGREGATE MATERIALS

5.1 Introduction

The previous chapters have identified the various mineral aggregate resources throughout Nova Scotia and New Brunswick and assessed the demand potential of foreign and domestic markets. In this chapter the means and costs of transporting aggregate from the source--quarries and pits of Nova Scotia and New Brunswick--to the potential markets are reported.

The availability of surplus aggregate resources produced at lower costs than prices in external consumer markets is a necessary condition in considering the feasibility of supplying those markets. However, this alone may not be sufficient to be competitive in those markets. The delivered price, which the purchaser pays for aggregate, is dependent upon the producer's cost plus the cost of having it transported. Aggregate materials are bulky, low-valued commodities which require large scale transportation systems and volumes for economic haulage. As such, the transportation of aggregate materials is a critical element in analyzing the feasibility of establishing external markets for the products.

Three available transport modes are considered in this analysis:

1. for-hire trucking mode,
2. rail and/or truck-to-rail mode, and
3. marine shipping and/or truck-to-marine mode.

Transport costs have been acquired for each of these modes from several resource points throughout Nova Scotia and New Brunswick to prospective foreign and domestic market centres. Since actual aggregate user destinations cannot be established for this analysis, transportation costs have been determined to major centres where the purchaser would be responsible for the stockpiling and/or direct delivery to its use destination. The price competitiveness of the aggregate material at the major centre is therefore comparable to any local pits and quarries or delivered product from other sources to that centre.

Freight rates for high-volume, low-value bulk haul commodities, such as aggregate materials, are derived from a complex of factors such as:

1. length and minimum operating cost of haul;
2. value and nature of commodity hauled;
3. annual volume, frequency and regularity of haul;
4. transport equipment availability and capital depreciation;
5. backhaul availability;
6. loading and unloading requirements;
7. intramodal and intermodal competition;
8. length of contract;
9. minimum load quantity or load factor;
10. layover or berthing time charges; and
11. general economic market conditions.

Freight rate analysts and agencies representing each mode were contacted and the above considerations discussed. In general, they were hesitant to commit themselves to negotiated contract freight rates due to the nature of this feasibility study, the uncertainty of the actual parameters, the lack of guarantee of a contract, and the start-up time of the potential business venture. However, they all were willing to produce representative freight rates under normal conditions as would apply to the commodity movements for 1985 prior to negotiating a specific contract. Therefore, the transport costs given in this report are to be viewed as representative rates, which are forwarded to the shipper at the onset of negotiations or presented for feasibility analyses purposes by freight rate analysts. This implies that they may be higher than negotiated contract freight rates with the carriers should business materialize.

The volume of freight to be hauled to any given market was established at a minimum of 500 000 tonnes per annum with the majority of demand occurring during the months of April to November. Stockpiling at the destination centre, if necessary, is normally the responsibility of the purchasing agent. Most aggregate materials would be under two inches, and therefore would not pose any loading or unloading problems or damage to the transport vehicles.

This chapter is divided into two sections:

1. aggregate transportation to foreign markets; and
2. aggregate transportation to domestic markets.

5.2 Aggregate Transportation to Foreign Markets

5.2.1 Introduction

In this section the transport costs of hauling aggregate materials (i.e., crushed stone and sand and gravel) originating from respective major quarries and pits throughout Nova Scotia and New Brunswick have been tabulated against prospective foreign market destinations in the eastern and southeastern United States. There are at present no commodity export tariffs applied to transborder shipments, or transport subsidies available to the carriers for mineral aggregate materials. Transport costs have been calculated in both $U.S. and $Can., for all export movements.

The following subsections report the carrier means and transport costs for each of the three available transport modes: trucking, rail and marine. Respective freight rates were acquired from the following sources:

1. For-hire truck freight rates: from Nova Scotia and New Brunswick Government Haulage Rates, and from Atlantic Provinces Transportation Commission (A.P.T.C.) representative commodity truck freight rates for hauling limestone and aggregate materials, as offered by a sample of for-hire trucking operators.

2. Rail freight rates: from CN Rail estimated representative rates for aggregate transport, and from A.P.T.C. representative commodity rail freight rates for burned shale, coal and limestone movements.

3. Marine freight rates: from A.P.T.C. representative marine freight rates from sample of Canadian steamship brokers, and representative transhipment/loading costs from Port of Saint John.

The conditions applicable to the transport freight rates will be outlined in the following discussions of transport costs by transport mode. Note that the exchange rate used in this analysis is $1.00 U.S. = $1.35 Can.

5.2.2 Aggregate Transportation by Trucking Mode

For-hire truck rates are presented on a per tonne-kilometre basis with minimum load of 23 tonnes. The truck configuration normally used to haul crushed stone or sand and gravel is a 35 tonne tandem triaxle, which in this case would be loaded to its maximum 35 tonne payload. In calculating truck transport costs, the minimum primary highway distances from the pit or quarry to the export market centres were used. This included the use of ferry crossings via the Yarmouth to Bar Harbour ferry for movements in Nova Scotia where its use was more economical than routing through New Brunswick. The Yarmouth to Bar Harbour ferry offers a once daily service from mid-May to mid-September and three times weekly during the remainder of the year. Round trip costs for the gravel trucks were $8.96 U.S. per tonne.

Tables 5.1 and 5.2 show the trucking costs of all aggregate materials from exemplary origins in Nova Scotia and New Brunswick to a sample of prospective export market centres in eastern United States. Table 5.1 figures are in $U.S./tonne and Table 5.2 $Can./tonne. These tables show the per tonne costs of transporting aggregate by truck ranging from $20.37 U.S. from Yarmouth to Portland and $20.44 U.S. from St. George to Portland to a high of $152.00 U.S. from Mulgrave to Savannah, Georgia.

The major advantage of truck haulage of aggregate materials is the capability of trucks to haul directly from the source quarries and pits to the actual user destination without any

TABLE 5.1

EXPORT AGGREGATE TRUCKING COSTS ($U.S./TONNE)

Destination Origin	Portland	Boston	New York	Phildelphia	Savannah
Fredericton	23.42	31.93	49.53	56.71	114.32
Saint John	23.61	33.54	51.14	58.33	115.92
St. George	20.44	30.22	47.82	55.01	112.59
Sussex	27.78	36.28	53.88	61.07	118.66
Grand Falls	27.04	35.55	53.15	60.33	117.93
Belledune	34.67	41.13	60.73	67.91	125.50
Moncton	31.54	40.04	52.07	64.83	122.42
Halifax	34.37*	42.87*	60.47*	67.66*	125.25*
Yarmouth	20.37*	28.40*	45.76*	52.94*	110.53*
Wentworth	39.36	47.87	65.47	72.65	130.24
Mulgrave	61.11	69.62	87.22	94.41	152.00
Coldbrook	30.89*	39.40*	57.00*	64.19*	121.78*

* Via ferry (Yarmouth - Bar Harbour)

TABLE 5.2

EXPORT AGGREGATE TRUCKING COSTS ($CAN./TONNE)

Destination Origin	Portland	Boston	New York	Phildelphia	Savannah
Fredericton	31.62	43.10	66.86	76.56	154.32
Saint John	31.88	45.28	69.04	78.75	156.49
St. George	27.59	40.80	64.56	74.26	152.00
Sussex	37.50	48.98	72.74	82.44	160.19
Grand Falls	36.50	47.99	71.75	81.45	159.20
Belledune	46.80	58.22	81.98	91.68	169.43
Moncton	42.58	54.06	70.30	87.52	165.27
Halifax	46.40*	57.88*	81.64*	91.34*	169.09*
Yarmouth	27.50*	38.34*	61.77*	71.47*	149.22*
Wentworth	53.14	64.62	88.38	98.08	175.83
Mulgrave	82.50	93.99	117.75	127.45	205.20
Coldbrook	41.70*	53.19*	76.95*	86.65*	164.40*

* Via ferry (Yarmouth - Bar Harbour)

transhipment on route or need for stockpiling. Some economies, due to the volume of demand for aggregate materials, could reduce the given freight rates significantly. Due to the flexibility of trucks in routing and for hauling a variety of products, partial or entire backhauls may be available, which could also reduce the trucking freight rates.

5.2.3 Aggregate Transportation by Rail Mode

Rail freight transport rates have been acquired for 90 tonne per carload hauls of aggregate materials, crushed stone and sand and gravel. Rail shipments are assumed to be on a multi-unit carload basis (i.e., not by dedicated unit train service, but pick-up of several cars at one time) using open-top gondola freight cars. Due to the complexity of estimating rail freight rates for transborder movements requiring revenue sharing with U.S. railways, only movements from Wentworth and Moncton to Boston were acquired for this analysis.

Rail transport costs for hauling aggregate from Moncton to Boston is $32.87 U.S. per tonne and $44.38 Can. per tonne. Rail transport costs per tonne from Wentworth to Boston is $36.86 U.S. and $49.76 Can. Estimates in U.S. and Canadian dollars for rail freight transport costs from various quarries and pits of Nova Scotia and New Brunswick to Boston are given in Table 5.3. Note that unless the pit or quarry has a rail siding for loading at the site, additional trucking changes must be added to the rail freight costs.

The rail official knew of no available backhaul commodities at present. Additional costs for construction of rail loading facilities might be necessary and more economical in the long run, if trucking costs to existing loading facilities are excessive.

5.2.4 Aggregate Transportation by Marine Mode

Marine ship freight rates are presented on a per tonne basis for movements from ports located in Nova Scotia and New Brunswick to eastern and southeastern United States ports. The ships recommended for use by the steamship brokers and operators were 35 000 or 40 000 tonne self-unloading bulk carrier vessels. Rates are given for loaded vessels and include unloading and other associated harbour charges. Note that only those ports capable of handling bulk freight carrier vessels with loading and unloading facilities available have been considered in this analysis. This information was available from the Canadian Ports and Seaway Directory and the Fairiplay World Ports Directory, published annually. Potential backhauls are presently limited to the phosphate transported northward from the U.S. on returning gypsum ships. Other potential for backhauls is being investigated, and if available, could reduce the marine freight rates given below significantly.

Tables 5.4 and 5.5 show the marine freight costs from ports located in Nova Scotia and New Brunswick to ports in the United States located in prospective market areas. Table 5.4 gives the per tonne costs in $U.S. and Table 5.5 in $Can. for shipping aggregate materials.

Additional freight costs are accrued from transporting from the quarry to its nearest port facilities. Based upon the per tonne-kilometre truck freight rates for hauling aggregate materials, transport costs to the Maritime ports from the Nova Scotia and New Brunswick quarries and pits are shown in Tables 5.6 to 5.9 in $U.S. and $Can.

TABLE 5.3

EXPORT RAIL FREIGHT COSTS FOR AGGREGATE TO BOSTON

Origin	$U.S.	$Can.
Fredericton	32.87	44.38
Saint John	32.87	44.38
St. George	32.87	44.38
Grand Falls	31.75	42.86
Belledune	32.87	44.38
Moncton	32.87	44.38
Halifax	39.12	52.81
Sydney	41.09	55.47
Wentworth	36.86	49.76
Mulgrave	40.44	54.60

Note:

All quarry/pit locations are along existing rail lines. Truck haulage rates per tonne to existing or specifically constructed load facilities are:

5 km = $0.94 U.S. = $1.27 Can.; 10 km = $1.37 U.S. = $1.85 Can.;
15 km = $1.81 U.S. = $2.44 Can.; 20 km = $2.25 U.S. = $3.04 Can.;
25 km = $2.72 U.S. = $3.67 Can.; 30 km = $3.13 U.S. = $4.23 Can.;
35 km = $3.50 U.S. = $4.72 Can.; 40 km = $3.82 U.S. = $5.16 Can.;
which would be in addition to these rail freight costs.

TABLE 5.4

EXPORT MARINE FREIGHT COSTS FROM ORIGINATING TO DESTINATION PORTS ($U.S./TONNE)

Destination Origin	Boston	New York	Philadelphia	Baltimore	Hampton	Wilmington, NC	Savannah	Miami	Houstor
Saint John	2.96	3.51	3.70	4.50	4.17	4.84	5.25	5.72	8.50
Newcastle	4.45	5.00	5.33	6.00	5.66	6.33	6.88	7.21	10.09
Belledune	4.61	5.17	5.65	6.16	5.83	6.49	7.50	7.68	10.20
Dalhousie	4.67	5.22	5.71	6.22	5.89	6.55	7.10	7.73	10.31
Sydney	3.73	4.28	4.61	5.28	4.95	5.61	6.16	6.49	9.37
Mulgrave	3.51	4.06	4.39	5.06	4.72	5.39	6.00	6.27	9.00
Halifax	3.18	3.73	4.06	4.72	4.39	5.06	5.61	5.94	8.82
Liverpool	3.01	3.56	3.90	4.56	4.23	4.89	5.44	5.77	8.65

TABLE 5.5

EXPORT MARINE FREIGHT COSTS FROM ORIGINATING TO DESTINATION PORTS ($CAN./TONNE)

Destination Origin	Boston	New York	Philadelphia	Baltimore	Hampton	Wilmington, NC	Savannah	Miami	Houston
Saint John	4.00	4.74	5.18	6.08	5.63	6.53	7.28	7.72	11.60
Newcastle	6.01	6.75	7.20	8.10	7.64	8.55	9.29	9.73	13.62
Belledune	6.22	6.98	7.43	8.32	7.87	8.76	9.52	9.96	13.84
Dalhousie	6.30	7.05	7.49	8.40	7.95	8.84	9.59	10.03	13.92
Sydney	5.04	5.78	6.22	7.13	6.68	7.57	8.32	8.76	12.65
Mulgrave	4.74	5.48	5.93	6.83	6.37	7.28	8.02	8.46	12.35
Halifax	4.29	5.04	5.48	6.37	5.93	6.83	7.57	8.02	11.91
Liverpool	4.06	4.81	5.27	6.16	5.71	6.60	7.34	7.79	11.68

TABLE 5.6

FOR-HIRE TRUCKING COSTS FROM QUARRY TO PORTS - N.S.

Quarry	Port	Cost ($U.S./tonne)	Cost ($Can./tonne)
Montague	Halifax	1.56	2.10
Halifax	Halifax	1.12	1.51
Bedford	Halifax	1.73	2.33
Dartmouth	Halifax	1.12	1.51
Folly Lake	Halifax	8.21	11.09
	Mulgrave	12.04	16.25
New Glasgow	Halifax	9.46	12.77
	Mulgrave	7.41	10.01
Mulgrave	Mulgrave	0.0	0.0
*Sydney	Sydney	1.81 - 2.25	2.44 - 3.04

* Potential source area not currently utilized.

TABLE 5.7

FOR-HIRE TRUCKING COSTS FROM QUARRY TO PORTS - N.B.

Quarry (Crushed Stone)	Port	Cost ($U.S./tonne)	Cost ($Can./tonne)
Moncton (Acadia Crushed Stone)	Saint John Newcastle	10.13 8.88	13.67 11.99
Moncton (Moncton Crushed Stone)	Saint John Newcstle	8.66 7.15	11.69 9.65
Fredericton	Saint John	7.01	9.47
Darlington	Dalhousie	0.77	1.04
Saint John (Brookville)	Saint John	1.03	1.39
Saint John (Brunswick-Blagdon)	Saint John	3.13	4.23
Havelock	Saint John	7.81	10.55
*East Charlotte Co.	Saint John	2.89 - 4.35	3.90 - 5.87

* Potential source area not currently utilized.

TABLE 5.8

FOR-HIRE TRUCKING COSTS FROM PIT TO PORTS - N.S.

Pit (Sand and Gravel)	Port	Cost ($U.S./tonne)	Cost ($Can./tonne)
Yarmouth	Liverpool	9.50	12.83
Bridgewater	Liverpool	4.18	5.64
Sydney (Martell's Const. Ltd.)	Sydney	1.37	1.85
Sydney (Municipal Ready Mix)	Sydney	0.94	1.27
Shubenacadie (Dillman Ent.)	Halifax	4.61	6.22
Shubenacadie (N.S. Sand & Gravel)	Halifax	4.61	6.22
Lantz	Halifax	3.88	5.24
Folly Lake (Permanent Concrete)	Halifax	8.21	11.09
	Mulgrave	12.04	16.25
Folly Lake (Warren Maritimes)	Halifax	8.21	11.09
	Mulgrave	12.04	16.25
Bedford	Halifax	1.20	1.62
*Coldbrook	Halifax	7.33	9.89
	Liverpool	9.99	13.49

* Potential source area not currently utilized

TABLE 5.9

FOR-HIRE TRUCKING COSTS FROM PIT TO PORTS - N.B.

Pit (Sand and Gravel)	Port	Cost ($U.S./tonne)	Cost ($Can./tonne)
Saint John (Brunswick-Blagdon)	Saint John	3.13	4.23
Woodstock	Saint John	11.68	15.77
Grand Falls	Dalhousie	11.50	15.53
	Belledune	14.21	19.19
	Saint John	17.01	22.97
Fredericton	Saint John	7.01	9.47
Bathurst (Blue Mtn)	Belledune	2.35	3.17
Darlington	Dalhousie	0.77	1.04
Red Bank (Chaddick Lake)	Newcastle	2.63	3.55

TABLE 5.10

EXPORT FREIGHT COSTS FROM ROCK QUARRIES TO DESTINATION PORTS ($U.S./TONNE)

Destination Origin	Boston	New York	Philadelphia	Baltimore	Hampton	Wilmington, NC	Savannah	Miami	Houston
Moncton (Acadia C.S.)	15.90	16.45	16.77	17.44	17.11	17.77	18.33	18.65	21.53
Moncton (Moncton C.S.)	14.41	14.96	15.29	16.03	15.62	16.29	16.85	17.17	20.05
Fredericton	12.79	13.33	13.66	14.33	14.00	14.66	15.22	15.54	18.42
Darlington	8.25	8.80	9.13	9.80	9.47	10.13	10.68	11.01	13.89
Saint John (Brookville)	6.80	7.35	7.67	8.34	8.01	8.68	9.23	9.56	12.43
Saint John (Brunswick)	8.91	9.45	9.78	10.45	10.11	10.78	11.34	11.66	14.54
Havelock	13.59	14.14	14.46	15.13	14.80	15.46	16.02	16.34	19.22
East Charlotte Co.*	8.66	9.21	9.54	10.20	9.87	10.54	11.09	11.42	14.29
Montague	7.54	8.10	8.42	9.08	8.76	9.42	9.97	10.31	13.19
Halifax	7.11	7.62	7.99	8.65	8.32	8.99	9.54	9.87	12.75
Bedford	7.71	8.27	8.60	9.25	8.93	9.60	10.14	10.48	13.36
Dartmouth	7.11	7.66	7.99	8.65	8.32	8.99	9.54	9.87	12.75
Folly Lake	14.20	14.76	15.08	15.74	15.42	16.08	16.63	16.97	19.85
New Glasgow	13.74	14.28	14.62	15.28	14.94	15.62	16.17	16.49	19.37
Mulgrave	3.51	4.06	4.39	5.06	4.72	5.39	5.94	6.94	9.15
Sydney*	8.35	8.90	9.22	9.90	9.57	10.22	10.78	11.11	14.00

* Potential source area not currently utilized

TABLE 5.11

EXPORT FREIGHT COSTS FROM ROCK QUARRIES TO DESTINATION PORTS ($CAN./TONNE)

Destination Origin	Boston	New York	Philadelphia	Baltimore	Hampton	Wilmington, NC	Savannah	Miami	Houston
Moncton (Acadia C.S.)	21.46	22.20	22.64	23.54	23.09	23.99	24.74	25.18	29.06
Moncton (Moncton C.S.)	19.45	20.19	20.64	21.54	21.09	21.99	22.74	23.18	27.06
Fredericton	17.26	18.00	18.44	19.34	18.89	19.79	20.54	20.98	24.86
Darlington	11.13	11.88	12.32	13.23	12.78	13.67	14.42	14.86	18.75
Saint John (Brookville)	9.18	9.92	10.36	11.26	10.81	11.71	12.46	12.90	16.78
Saint John (Brunswick)	12.02	12.767	13.20	14.10	13.65	14.55	15.30	15.74	19.62
Havelock	18.34	19.08	19.52	20.42	19.97	20.87	21.62	22.06	25.94
East Charlotte Co.*	11.69	12.43	12.87	13.77	13.32	14.22	14.97	15.41	19.29
Montague	10.18	10.93	11.37	12.26	11.82	12.72	13.46	13.91	17.80
Halifax	9.59	10.34	10.78	11.67	11.23	12.13	12.87	13.32	17.21
Bedford	10.41	11.16	11.60	12.49	12.05	12.95	13.69	14.14	18.03
Dartmouth	9.59	10.34	10.78	11.67	11.23	12.13	12.87	13.32	17.21
Folly Lake	19.17	19.92	20.36	21.25	20.81	21.71	22.45	22.90	26.79
New Glasgow	18.49	19.28	19.73	20.63	20.17	21.08	21.82	22.26	26.15
Mulgrave	8.53	9.27	9.72	10.62	10.16	11.07	11.81	12.25	16.14
Sydney*	11.27	12.01	12.45	13.36	12.91	13.80	14.55	15.00	18.89

* Potential source area not currently utilized

TABLE 5.12

EXPORT FREIGHT COSTS FROM SAND/GRAVEL PITS TO DESTINATION PORTS ($U.S./TONNE)

Destination Origin	Boston	New York	Philadelphia	Baltimore	Hampton	Wilmington, NC	Savannah	Miami	Houston
Yarmouth	15.32	15.88	16.21	16.87	16.54	17.20	17.74	18.08	20.96
Bridgewater	10.00	10.55	10.88	11.54	11.21	11.87	12.42	12.75	15.63
Sydney (Martell's CL)	7.91	8.46	8.79	9.46	9.13	9.79	10.34	10.68	13.54
Sydney (Municipal RM)	7.48	8.03	8.35	9.03	8.70	9.35	9.91	10.23	13.11
Shubenacadie	10.60	11.15	11.48	12.14	11.81	12.48	13.02	13.36	16.24
Lantz	9.87	10.42	10.75	11.41	11.08	11.75	12.30	12.63	15.51
Folly Lake	14.20	14.76	15.08	15.74	15.42	16.08	16.63	16.96	19.85
Bedford	7.19	3.74	8.07	8.73	8.40	9.07	9.62	9.95	12.83
Coldbrook*	13.31	13.87	14.20	14.85	14.53	15.20	15.74	16.08	18.96
Saint John	8.91	9.45	9.78	10.45	10.11	10.78	11.34	11.66	14.54
Woodstock	17.45	18.00	18.33	19.00	18.66	19.33	19.88	20.21	23.18
Grand Falls	18.98	19.53	19.85	20.52	20.19	20.85	21.41	21.74	24.61
Fredericton	12.79	13.33	13.66	14.33	14.00	14.66	15.22	15.54	18.42
Bathurst	9.77	10.33	10.66	11.32	10.99	11.65	12.21	12.54	15.42
Darlington	8.35	8.80	9.13	9.80	9.47	10.13	10.68	11.01	13.89
Red Bank	9.89	10.44	10.77	11.44	11.10	11.77	12.32	12.65	15.52

* Potential source area not currently utilized

TABLE 5.13

EXPORT FREIGHT COSTS FROM SAND/GRAVEL PITS TO DESTINATION PORTS ($CAN./TONNE)

Destination Origin	Boston	New York	Philadelphia	Baltimore	Hampton	Wilmington, NC	Savannah	Miami	Houston
Yarmouth	20.68	21.43	21.08	22.77	22.32	23.21	23.95	24.40	28.29
Bridgewater	13.49	14.24	14.69	15.58	15.13	16.02	16.76	17.21	21.10
Sydney (Martell's C.L.)	10.68	11.42	11.86	12.77	12.32	13.21	13.95	14.39	18.28
Sydney (Municipal R.M.)	10.10	10.84	11.28	12.19	11.74	12.63	13.37	13.80	17.70
Shubenacadie	14.30	15.05	15.49	16.38	15.94	16.84	17.58	18.03	21.92
Lantz	13.32	14.07	14.51	15.40	14.96	15.86	16.60	17.05	20.94
Folly Lake	19.17	19.92	20.36	21.25	20.81	21.71	22.45	22.90	26.79
Bedford	9.70	10.45	10.89	11.78	11.34	12.24	12.98	13.43	17.09
Coldbrook*	17.97	18.72	19.16	20.05	19.61	20.51	21.25	21.70	25.59
Saint John	12.02	12.76	13.20	14.10	13.65	14.55	15.30	15.74	19.62
Woodstock	23.56	24.30	24.74	25.59	25.19	26.09	26.84	27.28	31.16
Grand Falls	25.62	26.36	26.80	27.70	27.25	28.15	28.90	29.34	33.22
Fredericton	17.26	18.00	18.44	19.34	18.89	19.79	20.49	20.98	24.86
Bathurst	13.18	13.94	14.39	15.28	14.83	15.72	16.48	16.92	20.81
Darlington	11.13	11.88	12.32	13.23	12.78	13.67	14.42	14.86	18.75
Red Bank	13.35	14.09	14.54	15.44	14.98	15.89	16.63	17.07	20.95

* Potential source area not currently utilized

To complete the transportation costs of moving mineral aggregate materials from the quarries of Nova Scotia and New Brunswick to the major centres/ports in the United States east and southeast seaboards, the intermodal-truck-to-ship freight transport costs have been calculated. Tables 5.10 and 5.11 give the per tonne costs of transporting crushed stone from the major quarries of Nova Scotia and New Brunswick to the American ports in $U.S. and $Can., respectively. Similarly, Tables 5.12 and 5.13 give the per tonne costs of transporting sand and gravel from the major pits. Note that an additional average charge of $2.81 U.S. and $3.79 Can. per tonne is included in these costs for loading the aggregate materials onto a bulk carrier vessel at all originating Maritime ports, except at Porcupine Mountain (Mulgrave), upon transhipment from the trucks. This would require temporary stockpiling at the port during delivery of the shiploads by truck, so that loading of the aggregate onto the vessel can take place at one time. Estimated space requirements for stockpiling a 35 000 tonne shipload of aggregate would be 62 500 square feet piled with a 30° slope.

Total transport costs for moving aggregate by ship to prospective export markets in the United States range from $3.51* U.S. from Mulgrave to Boston to $21.53 U.S. from Acadia Crushed Stone in the Moncton area to Houston, Texas. Relative marine transport costs are greatly affected by the proximity of the quarry or pit to a bulk handling port facility.

At present, international marine shipping rates are depressed due to market conditions creating excess capacity available in the steamship industry. However, steamship brokers advised that normal freight rates be used in this feasibility analysis as current depressed freight rates are not expected to persist.

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* Note that the Mulgrave quarry is located at dockside; therefore, trucking, stevedoring and stockpiling costs are not applicable, as aggregate is belt loaded directly onto the ships.

5.3 Aggregate Transportation to Domestic Markets

5.3.1 Introduction

In this section, the transport costs of hauling aggregate from the major pits and quarries of Nova Scotia and New Brunswick to prospective major market centres of central Canada (Quebec and eastern Ontario), have been tabulated. The following subsections report the carrier means and transport costs for each of the three available transport modes: trucking, rail and marine. Freight rates were attained from the same sources as ascribed in Section 5.2.1 above. All domestic freight transport costs are given in $Can. only. No backhaul opportunities were known at present by the carriers.

5.3.2 Aggregate Transportation by Trucking Mode

As was the case with trucking aggregate to foreign markets, aggregate hauled to domestic market centres would be transported in 35 tonne tandem triaxle trucks. In this case, calculation of transport costs for some movements from Nova Scotia includes use of the Digby to Saint John ferry, which operates twice daily throughout the year and three times daily during the summer season at a round trip cost of $6.33 per tonne. Table 5.14 shows the transport costs of trucking aggregate from locations in Nova Scotia and New Brunswick to three major prospective domestic markets of Quebec City, Montreal and Toronto. The trucking costs range from $20.07 per tonne from Grand Falls to Quebec City to $130.75 from Mulgrave to Toronto.

5.3.3 Aggregate Transportation by Rail Mode

For aggregate materials transported by rail to domestic market centres, rail freight rates are based upon 90 tonne carloads using open-top gondola cars. Construction of dedicated rail

TABLE 5.14

DOMESTIC AGGREGATE TRUCKING COSTS ($CAN./TONNE)

Destination Origin	Quebec City	Montreal	Toronto
Fredericton	38.02	54.06	89.64
Saint John	45.22	61.26	96.90
St. George	43.83	59.87	95.44
Sussex	47.06	63.10	98.68
Grand Falls	20.07	35.25	70.83
Belledune	38.48	57.16	90.63
Moncton	52.61	68.38	102.31
Halifax	72.08	89.90	125.47
Yarmouth	58.70*	76.53*	110.37*
Wentworth	63.17	80.99	116.56
Mulgrave	81.05	96.83	130.75
Coldbrook	60.03*	77.85*	113.42*

* Via ferry (Digby - Saint John)

loading facilities may be required to gain long-run cost efficiencies over use of trucks for transporting from the pits or quarries to existing remote rail loading facilities.

Table 5.15 gives the rail freight costs of hauling aggregate to the major market centres--Quebec City, Montreal and Toronto. Rail transort costs to domestic markets range from a low of $16.00 per tonne from Grand Falls to Quebec City to a high of $44.70 from Sydney to Toronto.

Potential for use of unit trains with a dedicated service from the quarries or pits to the market destinations exists for domestic markets. However, a guaranteed long-term agreement would be required prior to any commitment to setting up a unit train system. Specialized rail loading and unloading and turn-around facilities would need to be constructed at each end of the system at a considerably high cost investment. Rail officials were not optimistic about the viability of a unit train system for the haulage of low valued aggregate materials.

5.3.4 Aggregate Transportation by Marine Mode

Marine ship freight rates for loaded vessels are presented in Table 5.16 from ports in Nova Scotia and New Brunswick to ports in Quebec City, Montreal and Toronto, including unloading and harbour charges at the destination port. The ship recommended by steamship brokers for use in the St. Lawrence Seaway was a 35 000 tonne self-unloading bulk carrier vessel. No potential backhaul opportunities were known at present.

Truck haulage rates from the quarries and pits located in Nova Scotia and New Brunswick are the same as those given previously in Tables 5.6 to 5.9. Transport costs from the sand and gravel pits and rock quarries to the domestic market ports are given in Tables 5.17 and 5.18, respectively.

TABLE 5.15

DOMESTIC RAIL FREIGHT RATES FOR AGGREGATE ($CAN./TONNE)

Destination Origin	Quebec City	Montreal	Toronto
Fredericton	18.12	20.32	31.81
Saint John	18.12	20.32	31.81
St. George	18.12	20.32	31.81
Grand Falls	16.60	18.62	29.15
Belledune	18.12	20.32	31.81
Moncton	18.12	20.32	31.81
Halifax	25.80	28.93	40.51
Sydney	28.46	31.92	44.70
Wentworth	20.92	23.46	32.85
Mulgrave	27.59	30.94	43.32
Truro	22.75	25.51	35.72

Note:

All quarry/pit locations are along existing rail lines. Truck haulage rates per tonne to existing or specifically constructed rail load facilities are:
5 km = $1.27; 10 km = $1.85; 15 km = $2.44; 20 km = $3.04; 25 km = $3.67; 30 km = $4.23; 35 km = $4.72; 40 km = $5.16; which would be in addition to these rail freight costs.

TABLE 5.16

DOMESTIC MARINE FREIGHT RATES FROM ORIGINATING TO DESTINATION PORTS ($CAN./TONNE)

Destination Origin	Quebec City	Montreal	Toronto
Saint John	6.55	7.30	10.45
Newcastle	5.15	6.05	9.45
Belledune	4.25	5.00	8.15
Dalhousie	4.25	5.00	8.15
Sydney	4.32	5.07	8.22
Mulgrave	4.30	5.05	8.20
Halifax	4.35	5.10	8.25
Liverpool	5.04	5.90	9.22

An average stockpiling and loading charge for transhipment from the trucks to the ship at the originating ports of $3.79 per tonne has been included in the transport costs. Therefore, total transport costs would range from a low of $4.30 per tonne for the Mulgrave to Quebec City movement, which does not require transhipment from trucks, due to the location of the quarry adjacent to the port, to a high of $30.01 per tonne for the Woodstock to Toronto movement with the added transhipment costs, as shown in Tables 5.17 and 5.18.

TABLE 5.17

DOMESTIC FREIGHT COSTS FROM ROCK QUARRIES TO DESTINATION PORTS ($CAN./TONNE)

Destination Origin	Quebec City	Montreal	Toronto
Moncton (Acadia CS)	20.93	21.83	25.23
Moncton (Moncton CS)	18.59	19.49	22.89
Fredericton	19.81	20.56	23.71
Darlington	9.08	9.83	12.98
Saint John (Brookville)	11.73	12.48	15.63
Saint John (Brunswick)	14.57	15.32	18.47
Havelock	20.89	21.64	24.79
East Charlotte Co.*	14.24	14.99	18.14
Montague	10.24	10.99	14.14
Halifax	9.65	10.40	13.55
Bedford	10.47	11.22	14.37
Dartmouth	9.65	10.40	13.55
Folly Lake	19.23	19.48	23.13
New Glasgow	18.10	13.85	22.00
Mulgrave	4.30	5.05	8.20
Sydney*	10.55	11.30	14.45

* Potential source not currently utilized

TABLE 5.18

DOMESTIC FREIGHT COSTS FROM SAND/GRAVEL PITS TO DESTINATION PORTS ($CAN./TONNE)

Destination Origin	Quebec City	Montreal	Toronto
Yarmouth	21.66	22.52	25.84
Bridgewater	14.47	15.33	18.65
Sydney (Martell's C.L.)	9.96	10.71	13.86
Sydney (Municipal R.M.)	9.38	10.13	13.28
Shubenacadie	14.36	15.11	18.26
Lantz	13.33	14.13	17.28
Folly Lake	19.23	19.98	23.13
Bedford	9.76	10.51	13.66
Coldbrook*	18.03	18.78	21.93
Saint John	14.57	15.32	18.47
Woodstock	26.11	26.86	30.01
Grand Falls	23.57	24.32	27.47
Fredericton	19.81	20.56	23.71
Bathurst	11.21	11.96	15.11
Darlington	9.08	9.83	12.98
Red Bank	12.44	13.24	16.56

* Potential source area not currently utilized

6.0 MARKET EVALUATION

6.1 Introduction

While an aggregate producer can control many of the variables involved in production, price, and distribution, he is also influenced by many market variables which are beyond his control. These uncontrollable variables include competition, legal and political actions, technology, and public attitudes.

It is important that a producer become informed and remain current about developments in uncontrolled variables. By so doing, the producer can anticipate changes in market conditions and use opportunities to advantage.

6.2 Competition - Identity, Size and Location

6.2.1 United States

In order to facilitate entry into a market, it is best to carefully study the existing structure of that market. In particular, existing suppliers must be analyzed to determine their strengths and weakness. To this end, each market area was investigated with the intention of determining the identity, location, supply source, and size of suppliers.

Presented in Summary Tables 6.1 and 6.2 are details of prominent aggregate suppliers in the United States.

As shown in the Summary Tables 6.3 and 6.4, there is great variation in the number, size and type of aggregrate suppliers throughout the United States. Sand and gravel producers tend to be small in New England, medium-sized in the south (except Texas) and large in the Middle and South Atlantic states. Crushed rock operations tend to be large in the South Atlantic and Gulf of Mexico markets.

Further analysis shows that certain markets and submarkets can be characterized according to the level of competition (see Tables 6.5 and 6.6) and the control that certain suppliers have on various submarkets. A high level of competition is indicative of a market with many small or very small suppliers, none of which has a market share over 5 percent. A medium level occurs in a market with several large and medium sized firms with one or two holding a share over 5 percent. A low level occurs when there are several very large, large and medium firms with more than two holding 5 percent market share. A very low level occurs when there are many very large and large firms with several holding market shares over 10 percent.

For a New Brunswick or Nova Scotia supplier, it would be preferable to enter markets with high or medium levels of competition, as there would be little organized opposition to market penetration. Markets with low or very low levels of competition would be more difficult to enter, as the supplier would be faced with a few well-entrenched, financially strong competitors.

Based upon this analysis, the preferred markets would be:

Sand and Gravel - all except Florida.

Crushed Rock - Massachusetts
New York
Virginia
Florida
Louisiana

TABLE 6.1
CHARACTERISTICS OF PROMINENT SAND
AND GRAVEL SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
Maine	Cianbro Corporation	Medium	Pittsfield	U	Androscoggin	U
				1	Franklin	Small
				1	Hancock	Small
				2	Oxford	Both Medium
				1	Penobscot	Medium
				2	Somerset	Both Small
	Harry C. Crooker & Sons Inc.	Small	Brunswick	1	Lincoln	Small
				1	Sagadahoc	Medium
	Blue Rock Industries	Medium	Westbrook	2	Androscoggen	Both Medium
				1	Franklin	Medium
				1	Franklin	Small
	Maine Department of Transportation	Medium	Augusta	U	Androscoggin	U
				2	Aroostock	Both Small
				4	Cumberland	All Small
				1	Franklin	Small
				U	Hancock	U
				2	Oxford	Both Small
				U	Penobscot	U
				1	Sagadahoc	Medium
				U	Somerset	U
				2	Waldo	Both Small
				1	Washington	Small

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.1 (continued)
CHARACTERISTICS OF PROMINENT SAND AND GRAVEL SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
Maine	Tilcon Inc. (Warren) Bros)	Small	Fairfield	1	Cumberland	Small
				1	Penobscot	Small
				2	Somerset	Small
				1	York	Medium
	Lane Construction Co.	Small	Westfield	1	Aroostook	Small
				2	Penobscot	Both Small
				1	Waldo	Small
				1	Washington	Small
New Hampshire	Manchester Sand and Gravel	Small	Hooksett	3	Merrimack	2 Small 1 Medium
	Ossippee Aggregate Corp	Small	Ossipee	1	Carroll	
	F.W. Whitcomb Construction Corp.	Small	Bellous Falls VT	1	Cheshire	
Massachusetts						
	S.M. Lorusso & Sons Inc.	Small	Walpole	4	Norfolk	3 Small 1 Medium

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.1 (continued)
CHARACTERISTICS OF PROMINENT SAND AND GRAVEL SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
Massachusetts						
	J.H. Lynch & Sons Inc.	Small	Ashton	1	Providence	Medium
Rhode Island	River Sand and Gravel Co. Inc.	U	Pawtucket	U	Providence	U
	South County Sand and Gravel Co. Inc.	U	Peace Dale	U	Providence	U
Connecticut						
	Dan Beard Inc.	Small	Shelton	2	New Haven	1 Small 1 Medium
	Connecticut Sand and Stone Corp	Small	Plainville	1 1	Hartford Litchfield	Small Medium
New York	Buffalo Slag	Medium	Buffalo	1 1	Cattaraugus Allegary	Medium Medium
	Concrete Materials Inc.	Medium	Oswego	1 1 1	Tioga Clinton Cortland (dredge)	Medium Medium Medium

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.1 (continued)
CHARACTERISTICS OF PROMINENT SAND
AND GRAVEL SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
New York	Rose Stone & Concrete Inc.	Small	Binghampton	2	Broome	1 Small 1 Medium
New Jersey	Ralph Clayton & Sons	Small	Lakewood	1 2	Burlington Ocean	Small 1 Small 1 Medium
	Stavolva Sand & Gravel Inc.	Small	Felton	1	Ocean	Medium
	Jesse S Moire & Son Inc.	Large	Mauricetown	1 3	Camden (dredge) Cumberland	Medium 1 Small 1 Medium 1 Large
Pennsylvania						
	Whitehead Brothers Co.	Medium	Dorchester	2	Cumberland	Both Medium
	Davison Sand & Gravel Co.	Medium	New Kensington	1 3	Armstrong Westmoreland (2 dredges)	Medium All Medium
	Dravo Corp	Small	Pittsburgh	U 2	Alleghany Beaver (1 dredge)	U 1 Small 1 Medium

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.1 (continued)
CHARACTERISTICS OF PROMINENT SAND AND GRAVEL SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
Pennsylvania						
	Erie Sand Steamship Co.	Medium	Erie	1	Erie	Large
	Shippingport Sand & Gravel Co.	Small	Youngstown, OH	1	Beaver	Medium
	Warner Co.	Small	Morrisville	1	Bucks	Medium
Maryland	Charles County Sand and Gravel Co.	Medium	Waldorf	1	Charles	Large
	Genstar Stone Products	U	Hunt Valley	U U	Anne Arundel Baltimore	U U
	J.E. Owens III Contracting	Small	Harwood	1	Anne Arundel	Medium
	York Building Products Co. Inc.	Medium	York	1 2	Cecil Worcester	Medium Small Medium

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.1 (continued)
CHARACTERISTICS OF PROMINENT SAND AND GRAVEL SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
Virginia	Lone Star Industries Inc.	Large	Richmond	2	Henrico	Medium
				1	Prince George	Large
				1	Chesterfield	Medium
						Large
	Sadler Materials Corp.	Small	Petersburg	1	Henrico	Medium
	Unimen Corp.	Medium	Gore	1	Frederick	Large
	West Sand and Gravel Co.	Medium	Richmond	1	Henrico	Medium
				1	Rockingham	Small
North Carolina	B.V. Hedrick Gravel & Sand Co.	Large	Swananoa	1	Buncombe	Larage
				1	Anson	Large
	W.R. Bonsal Co.	Medium	Lilesville	1	Anson	Large
	Becker Sand and Gravel	Large	Cheraw, S.C.	2	Harnett	Medium
				1	Cumberland	Large
						Small

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.1 (continued)
CHARACTERISTICS OF PROMINENT SAND AND GRAVEL SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
South Carolina	Becker Sand and Gravel	Large	Cheraw	2	Marlboro	Large Large
				1	Chesterfield	Medium
				2	Florence (dredge)	Small
				1	Sumter	Large
	Foster-Dixiana Sand Co.	Small	Columbia	2	Lexington	Small Medium
	Martin-Marietta Corp.	Small	Lugoff	1	Kershaw	Medium
	Whitehead Brothers Co.	Small	Florham Park, N.J.	1	Kershaw	Medium
Georgia	Atlanta Sand and Supply Co. (Crawford Co. Mining Inc.)	Small	Roberta	1	Crawford	Medium
Florida	Florida Rock Industries Inc.	Medium	Interlachon	1	Glades (dredge)	Small
				1	Polk (dredge)	Small
				2	Lake (1 dredge)	Both Small
				1	Clay (dredge)	Medium
				1	Putman (dredge)	Medium

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.1 (continued)
CHARACTERISTICS OF PROMINENT SAND AND GRAVEL SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
Florida	E.R. Jahna Ind. Inc.	Medium	Lake Wales	2	Polk (1 dredge)	Both Small
				1	Lake (dredge)	Small
				5	Glades (dredge)	Large
	Silver Sand Co. of Clermont Inc.	Small	Clermont	1	Lake	Medium
	Radcliff Materials Inc.	Medium	Mobile	2	Gadsden	Both Medium
Alabama	Holland & Woodward Co. Inc.	Small	Decatur	1	Franklin	Medium
	R & S Materials Inc.	Small	Montgomery	2	Montgomery	Both Small
	Radcliff Materials Inc.	Medium	Montgomery	2	Montgomery (1 dredge)	Both Medium
				1	Mobile	Medium
	Southern Industries	-	-	-	-	-
	Hardy Sand Co. Inc.	Small	Mauricetown, N.J.	1	Tuscaloosa (dredge)	Medium
	Waugh S&G Inc.	Small	Montgomery	1	Montgomery	Medium

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.1 (continued)
CHARACTERISTICS OF PROMINENT SAND AND GRAVEL SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
Mississippi	Blain Gravel Co.	Medium	Crystal Springs	3	Capiah	2 Small Medium
				1	Marin (dredge)	Small
				1	Jefferson Davis	Small
	Farrish Sand and Gravel Co. Inc.	Medium	Greenwood	1	Panola	Large
					Carroll	Medium
Louisiana	Gifford Hill & Co. Inc.	Medium	Shreveport	2	Tangipahorn (1 dredge)	Both Medium
				1	Allen (dredge)	Medium
				4	Webster	Medium
	Louisiana Sand and Gravel Co.	Small	Baton Route	2	St. Helena (dredge)	Both Medium
	Standard Gravel Co. Inc.	Small	Franklinton	3	Washington	Medium
				1	St. Tammany	Small
	Texas Industries Inc.	Medium	Alexandra	1	Washington	Medium
				1	Ouachita	Medium
				1	Rapides	Small
				1	LaSalle	Medium

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.1 (continued)
CHARACTERISTICS OF PROMINENT SAND AND GRAVEL SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
Texas						
	Capital Aggregates	Medium	San Antonio	1	Bexar	Medium
				1	Travis	Medium
	Fordce Co.	Medium	San Antonio	2	Victoria	Both Medium
				1	Hidalgo	Large
	Gifford Hill & Co. Inc.	Medium	Dallas	2	Brazos	Small Medium
				1	McLennan	Medium
				1	Dallas	Medium
	Lone Star Industries Inc.	Large	Dallas	2	Dallas	Both Medium
				4	Colorado (3 dredge)	2 Small 2 Large
				1	Lempasas	Medium
				1	Fort Bend	Small
	Parker Bros. and Co. Ltd.	Medium	Houston	1	Victoria	Large
				1	Harris (dredge)	Small
				1	Montgomery (dredge)	Small
				1	Colorado	Medium

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.1 (continued)
CHARACTERISTICS OF PROMINENT SAND AND GRAVEL SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
Texas	Texas Industries Inc.	Very Large	Arlington	1	Ellis	Medium
				1	Colorado	Large
				2	Tarrant	Medium
						Large
				1	Parker	Medium
				2	Denton	Small
						Medium
				1	Travis	Medium
				1	Dallas	Medium
				1	Somerville	Medium
				1	Wise	Medium
	Thorstenbery Materials Corp.	Very Large	Garwood	1	Fayette	Medium
				2	Colorado	Large
						Very Large

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.2
CHARACTERISTICS OF PROMINENT CRUSHED ROCK SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
Maine	Blue Rock Industries	Small	Westbrook	1	Kennebec	Medium
	Lime Products Corp.	Small	Union	2	Knox	Both Medium
New Hampshire	Iafolla Industries Inc.	Small	Portsmouth	1	Rockingham	Medium
Massachusetts	Pfizer Inc.	Very Large	Adams	1	Berkshire	Very Large
	Lee Lime Corp.	Medium	Lee	2	Berkshire	Small, Large
	Telcon Warren Quarries Inc.	Small	Acushnet	1	Briston	Medium
	Lynn Sand and Stonescott	Small	Swampscott	1	Essex	Medium

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.2 (continued)
CHARACTERISTICS OF PROMINENT CRUSHED ROCK SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
Connecticut						
	Tilcon Inc.	Very Large	N.Branford	2	New Haven	Very Large Large
				2	Hartford	Medium Large
				1	Windham	Medium
	Edward Balf	Small	Newington	1	Hartford	Large
New York						
	General Crushed Stone Co.	Large	Easton, PA	1	Jefferson	Large
				1	Ontario	Medium
				1	Wayne	Medium
				1	Livingston	Medium
				1	Onondaga	Medium
	Allied Chemical	Medium	Jamesville	1	Onondaga	Large
				1	Lewis	Small
				1	Herkimer	Small
New Jersey						
	Anthony Ferrante and Sons Inc.	Medium	Bernardsville	1	Sumerset	Large
				1	Hunterdon	Small
	Tri-County Asphalt Corp.	Small	Lakehopatcong	1	Essex	Large

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.2 (continued)
CHARACTERISTICS OF PROMINENT CRUSHED ROCK SUPPLIERS
IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
New Jersey	Riverdale Quarry	Small	Riverdale	1	Morris	Medium
	Tilcon-Warren Quarries Inc.	Medium	Haledon	1	Passaic	Large
	Trap Rock Industries Inc.	Large	Kingston	1	Hunterdon	Medium
				1	Someset	Very Large
				1	Mercer	Medium
Pennsylvania	New Enterprise Stone and Lime Co.	Large	New Enterprise	1	Huntingdon	Medium
				2	Blau	Small Large
				2	Somerset	Both Medium
				1	Franklin	Medium
	D.M.Stolzfus and Son	Medium	Talmage	2	Lancaster	Medium Large
				1	Westmoreland	Medium
	Warner Co.	Small	Blairsville	1	Huntingdon	Medium

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.2 (continued)
CHARACTERISTICS OF PROMINENT CRUSHED ROCK
SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
Maryland	Genstar Stone Products Corp.	U	Frederick	U	U	U
	Arundel Corp.	Medium	Baltimore	2 1	Baltimore Harford	Medium Medium Large
	Rockville Crushed Stone Inc.	Large	Rockville	1 1	Montgomery Baltimore	Very Large Small
	D.M. Stoltzfus and Son	Small	Talmage, PA	1	Cecil	Large
Virginia	Lone Star Industries Inc.	Large	Norfold	1 1	Chesterfield Dinwiddie	Medium Large
	Vulcan Materials	Very Large	Winston Salem, N.C.	1 1 2 1 1 1 1	Prince William Stafford Fairfax Goochland Brunswick Halifax Pittsyliania	Large Medium Medium Large Medium Large Medium Medium

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.2 (continued)
CHARACTERISTICS OF PROMINENT CRUSHED ROCK SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
Virginia	Blue Ridge Stone Co.	Medium	Roanoke	1	Botetourt	Large
				1	Campbell	Large
	W.S. Frey	Medium	Clearbrook	1	Frederick	Large
	General Crushed Stone	Medium	Easton, PA	1	Hanover	Large
	Chantilly Crushed Stone	Medium	Chantilly	1	Loudon	Large
	Rockydale Quarries	Small	Concord	1	Campbell	Medium
	James River Hydrated and Supply	Medium	Buchanan	1	Russell	Large
	Greer Lime Co.	Medium	Saltville	1	Smyth	Large
	Luck Stone Corp.	Large	Richmond	2	Goochland	Both Medium
				1	Albermarle	Medium
				1	Fairfax	Medium
				1	Nottoway	Medium
				1	Augusta	Medium
	Daniel Construction	Medium	Warm Springs	1	Bath	Large

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.2 (continued)
CHARACTERISTICS OF PROMINENT CRUSHED ROCK
SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
North Carolina	Martin Marietta Corp.	Very Large	Raleigh, N.C.	2	Rowan	Medium Large
				1	Pitt	Medium
				1	Rockingham	Medium
				1	Catawla	Large
				1	Craven	Large
				2	Guildford	Large Medium
				2	Mecklenburg	Medium Large
				1	Cleveland	Medium
				1	Davidson	Medium
				1	New Hanover	Large
				1	Alamance	Medium
				1	Onslow	Medium
				1	Wake	Medium
				1	Lee	Large
				1	Iredell	Medium
				1	Randolph	Medium
				1	Gaston	Medium
	Nello L. Teer Co.	Very Large	Durham	2	Wake	Medium Large
				1	Wilson	Large
				1	Johnston	Medium
				1	Durham	Large
				1	Edgecombe	Medium

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.2 (continued)
CHARACTERISTICS OF PROMINENT CRUSHED ROCK
SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
North Carolina	North Carolina Granite Corp.	Very Large	Mt. Airy	1	Surry	Very Large
	Vulcan Material Co.	Very Large	Winston-Salem	1	Wilkes	Medium
				1	Caswell	Medium
				1	Davie	Medium
				1	Rockingham	Large
				2	Forsyth	Very Large Medium
				1	Henderson	Medium
				1	Guilford	Small
				1	Vance	Large
				1	Mecklenburg	Medium
				1	Surry	Medium
				1	Buncombe	Large
South Carolina	Vulcan Materials Co.	Large	Atlanta, GA	1	Laurens	Medium
				1	Spartanberg	Large
				1	Greenville	Large
				1	Pickens	Large
	Martin Marietta	Large	Raleigh, NC	1	Berkeley	Medium
				1	Lexington	Large
				2	York	Medium Small
				1	Richland	Medium
				1	Georgetown	Medium

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.2 (continued)
CHARACTERISTICS OF PROMINENT CRUSHED ROCK
SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
Georgia	Martin Marietta	Very Large	Raleigh, NC	1	Warren	Large
				1	Richmond	Large
				1	Jones	Large
	Florida Rock Industries Inc.	Very Large	Rome	1	Floyd	Large
				1	Spaulding	Medium
				1	Clayton	Medium
				1	Fayette	Medium
				1	Monroe	Large
				1	Muscogee	Large
	Georgia Marble Co.	Very Large	Lithonia	1	Newton	Medium
				1	Forsyth	Medium
				1	Douglas	Medium
				1	DeKall	Large
				1	Whitfield (mill)	Medium
				7	Pickens (3 mills) (4 underground)	1 Very Large 1 Large 3 Medium 2 Small
				3	Gilmer (all underground)	2 Medium 1 Small

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.2 (continued)
CHARACTERISTICS OF PROMINENT CRUSHED ROCK
SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
Florida	Florida Crushed Stone Co.	Very Large	Perry	1 1 1	Taylor Lake Hernando	Medium Small Very Large
	Florida Rock Industries Ltd.	Very Large	Interlachen	1 1 1 1	Levy Hernando Sumter Lee	Large Very Larage Medium Very Large
	Lone Star Florida Inc.	Very Large	Hialeah	1	Dade	Very Large
	Rinker Southeastern Materials Inc.	Very Large	Hialeah	3	Dade	1 Medium 1 Large 1 Very Large
	Vulcan Materials Co.	Large	Atlanta, GA	2 1	Dade Broward	1 Small 1 Large 1 Medium
Alabama	Allied Products Co.	Small	Alabaster	1	Shelby	Large
	Hoover Inc.	Medium	Hollywood	1 1	Jackson Colbert	Small Large

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.2 (continued)
CHARACTERISTICS OF PROMINENT CRUSHED ROCK
SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
Alabama	Ideal Basic Industries	Small	Purdue Hill	1	Monroe	Medium
	Southern Stone Co. Inc.	Large	Birmingham	4	Shelby	3 Medium 1 Large
				1	Colbert	Medium
				1	Lee	Medium
	Vulcan Materials Co.	Very Large	Birmingham	1	Calhoun	Medium
				2	Shelby	1 Medium 1 Large
				1	Jackson	Medium
				1	Franklin	Medium
				1	Etouah	Medium
				1	Colbert	Medium
				1	Madison	Medium
Mississippi	Mississippi Stone Products	Small	Inka	1	Tishomingo	Large
Louisiana	Radcliff Materials Inc.	Large	Morgan City	2	Orleans (both dredge)	Both Medium
				3	St. Mary (all dredge)	All Medium

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.2 (continued)
CHARACTERISTICS OF PROMINENT CRUSHED ROCK
SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
Louisiana	Pontchartrain Dredging Corp.	Small	New Orleans	2	Orleans (both dredge)	Both Medium
Texas	General Portland Inc.	Very Large	Dallas	1	Wise	Very Large
	Gifford-Hill and Co. Inc.	Large	Dallas	1	Wise	Very Large
				1	Hudspeth	Medium
	Lone Star Industries	Very Large	Houston	1	Wise	Large
				1	Harris	Very Large
				1	Burnet	Large
	Texas Crushed Stone Co.	Very Large	Georgetown	1	Williamson	Very Large
	Texas Industries Inc.	Very Large	Arlington	1	Williamson	Very Large
				1	Wise	Large
				1	Jack	Medium
	Vulcan Materials Co.	Large	Birmingham, AL	2	Bexar	Both Medium
				1	Grayson	Medium
				1	Wise	Large

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.2 (continued)
CHARACTERISTICS OF PROMINENT CRUSHED ROCK
SUPPLIERS IN THE UNITED STATES

SUBMARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATIONS (COUNTY)	SIZE
Texas	White's Mines Inc.	Large	San Antonio	2	Upalde	Large Medium
				1	Brown	Large
				1	Parker	Medium
				1	Taylor	Medium
	Parker Bros. and Co. Inc.	Large	Houston	1	Calhoun	Medium
				1	Comal	Large

Company Size:
Very Small - not listed
Small - 10 - 39 employees
Medium - 40 - 99 employees
Large - 100 - 199 employees
Very Large - Over 199 employees

Pit Size:
Small - 0 - 9 employees
Medium - 10 - 34 employees
Large - 35 - 99 employees
Very Large - Over 99 employees
U - Unknown

TABLE 6.3
SIZE DISTRIBUTION OF SAND AND GRAVEL SUPPLIERS IN THE UNITED STATES

			NUMBER OF SUPPLIERS			
MARKET	SUBMARKET	VERY LARGE	LARGE	MEDIUM	SMALL	UNAVAILABLE
New England	Maine	-	-	3	3	-
	New Hampshire	-	-	-	3	-
	Massachusetts	-	-	-	2	-
	Rhode Island	-	-	-	-	2
	Connecticut	-	-	-	2	-
Middle Atlantic	New York	-	-	2	1	-
	New Jersey	-	1	2	-	-
	Pennsylvania	-	-	3	3	-
	Delaware	-	-	-	-	-
	Maryland	-	-	2	1	1
	Virginia	-	1	2	1	-
South Atlantic	North Carolina	-	2	1	-	-
	South Carolina	-	1	-	3	1
	Georgia	-	-	-	1	-
	Florida	-	-	3	1	-
Gulf of Mexico	Alabama	-	-	1	4	-
	Mississippi	-	-	2	-	-
	Louisiana	-	-	2	2	-
	Texas	2	1	4	-	-

TABLE 6.4
SIZE DISTRIBUTION OF CRUSHED ROCK SUPPLIERS IN THE UNITED STATES

MARKET	SUBMARKET	NUMBER OF SUPPLIERS				
		VERY LARGE	LARGE	MEDIUM	SMALL	UNAVAILABLE
New England	Maine	-	-	-	2	-
	New Hampshire	-	-	-	1	-
	Massachusetts	1	-	1	2	-
	Rhode Island	-	-	-	-	-
	Connecticut	1	-	-	1	-
Middle Atlantic	New York	-	1	1	1	-
	New Jersey	-	1	2	2	-
	Pennsylvania	-	1	1	1	-
	Delaware	-	-	-	-	-
	Maryland	-	1	1	1	1
	Virginia	1	2	7	1	-
South Atlantic	North Carolina	4	-	-	-	-
	South Carolina	-	2	-	-	-
	Georgia	3	-	-	-	-
	Florida	4	1	-	-	-
Gulf of Mexico	Alabama	1	1	1	2	-
	Mississippi	-	-	-	1	-
	Louisiana	-	1	-	1	-
	Texas	4	4	-	-	-

TABLE 6.5 - NUMBER OF SAND AND GRAVEL OPERATIONS AND THEIR OWNERSHIP

	Ownership, Size of Supplier						
Submarket	Very Large	Large	Medium	Small	Very Small and Unknown	Total	Level of Competition*
Maine	—	—	28	12	95	135	Medium
New Hampshire	—	—	—	5	34	39	High
Massachusetts	—	—	—	5	110	115	High
Rhode Island	—	—	—	—	14	14	Medium
Connecticut	—	—	—	4	75	79	High
New York	—	—	5	2	347	354	High
New Jersey	—	4	—	4	53	61	Medium
Pennsylvania	—	—	7	5	112	124	Low (3 firms = 32%)
Delaware	—	—	—	—	8	8	Medium (imports important)
Maryland	—	—	4	1	40	45	Medium
Virginia	—	4	3	1	49	57	Medium
North Carolina	—	5	1	—	94	100	Medium
South Carolina	—	6	—	4	31	41	Medium
Georgia	—	—	—	1	31	32	Medium (19 pits = 89%)
Florida	—	—	16	1	23	40	Low (11 firms = 89%)
Alabama	—	—	3	5	58	66	Medium (26 firms = 85%)

TABLE 5 (continued)

	Ownership, Size of Supplier						
Submarket	Very Large	Large	Medium	Small	Very Small and Unknown	Total	Level of Competition*
Mississippi	--	--	6	--	63	69	High
Louisiana	--	--	11	6	63	80	Medium (6 firms = 40%)
Texas	14	4	13	--	120	151	Medium
Total	14	23	97	56	1412	1602	

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*Level of competition terms are described in text.

TABLE 6.6 - NUMBER OF CRUSHED ROCK OPERATIONS
AND THEIR OWNERSHIP

	Ownership, Size of Supplier						
Submarket	Very Large	Large	Medium	Small	Very Small or Unknown	Total	Level of Competition*
Maine	—	—	—	2	U	U	Likely low
New Hampshire	—	—	—	1	U	U	Likely low
Massachusetts	1	—	2	2	13	18	Medium
Rhode Island	—	—	—	—	U	U	Unknown
Connecticut	5	—	—	1	4	10	Low
New York	—	5	3	—	67	75	High
New Jersey	—	3	3	2	9	17	Low
Pennsylvania	—	3	3	1	150	157	Low (5 firms = 33%)
Delaware	—	—	—	—	—	0	None (all imports)
Maryland	—	2	3	1	13	19	Low
Virginia	8	8	9	—	72	97	Medium
North Carolina	39	—	—	—	35	74	Very low
South Carolina	—	10	—	—	9	19	Low
Georgia	24	—	—	—	32	55	Low
Florida	11	3	—	—	49	63	Medium (15 quarries = 57%)
Alabama	8	6	2	2	16	34	Low (12 firms = 90%)

TABLE 6.6 (continued)

	Ownership, Size of Supplier						
Submarket	Very Large	Large	Medium	Small	Very Small or Unknown	Total	Level of Competition*
Mississippi	--	--	--	1	U	U	Very low (3 firms = 95%)
Louisiana	---	5	--	2	U	U	Medium (material is shell)
Texas	12	9	--	--	22	43	Low (4 firms = 29%)
Total	108	54	24	15	491+	681+	

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*Level of competition terms are described in text.

6.2.2 Quebec and Ontario

Details of aggregate suppliers in Quebec and Ontario are presented in Tables 6.7 and 6.8 and a summary is presented in Table 6.9. The two markets provide an interesting contrast: Quebec's crushed stone industry is much larger than its sand and gravel industry, while the positions are reversed in Ontario. Competition is high in Quebec's crushed stone industry and Ontario's sand and gravel industry; it is medium in Quebec's sand and gravel industry and low in Ontario's crushed stone industry.

Based upon this analysis, a New Brunswick or Nova Scotia supplier would find competition tough in the Ontario crushed stone market, but moderate in Ontario's sand and gravel market and both Quebec's sand and gravel and crushed stone markets.

6.3 Financial Analysis of Industry

6.3.1 United States

Every industry has an identifiable pattern of costs and investment due to the similarity of inputs and assets required for production. By analyzing this pattern, a New Brunswick or Nova Scotia producer can compare the financial pattern of suppliers in target markets to his own. This comparison, in turn, can provide insights into the strengths and weaknesses of potential competitors. As an example, he may discover that those suppliers may have a much higher cost of supplies or a greater investment in machinery and equipment, both of which reduce the ability of competitors to lower prices.

Presented in Table 6.10 are several important financial characteristics of aggregate firms in leading producing states. As stated previously, these characteristics tend to follow an industry pattern, common to both crushed rock and sand and gravel producers.

TABLE 6.7
CHARACTERISTICS OF PROMINENT SAND AND GRAVEL SUPPLIERS IN QUEBEC AND ONTARIO

MARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATION	SIZE
Quebec	Les Enterprises Loma Ltée	Small	Beauport	1	Beauport	Medium
	Bédard Québec Inc.	Small	Loretville	1	Lorettville	Medium
	Sables Fournel à Fils Inc.	Small	Ste-Anne-des-Plaines	1	Ste-Anne-des-Plaines	Medium
	Sable L.G. Ltée	Small	New Glasgow	1	New Glasgow	Medium
	Sablière Warwick Ltée	Small	Warwick	1	Warwick	Medium
Ontario	Adams Sand and Gravel Ltd.	Small	Chatham	1	Chatham	Medium
	Alex Newbigging Ltd.	Small	Delaware	1	Delaware	Medium
	Ambro Materials and Construction	Small	Brampton	1	Brampton	Medium
	Barclay Transport	Small	Brooklin	1	Brooklin	Medium

Company Size

Very Small - Not listed
Small - 10-40 employees
Medium - 50-90 employees
Large - 100-199 employees
Very Large - over 199 employees

TABLE 6.7 (continued)
CHARACTERISTICS OF PROMINENT SAND
AND GRAVEL SUPPLIERS IN QUEBEC AND ONTARIO

MARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATION	SIZE
Ontario	Burnside Sand and Gravel and Burnside Aggregates	Small	Nepean	1	Nepean	Medium
	Caledon Sand and Gravel Ltd.	Small	Toronto	1	Toronto	Medium
	Circle Construction Co. Ltd.	Small	Sudbury	1	Sudbury	Medium
	Cliff Varcoe Ltd.	Small	Barrie	1	Barrie	Medium
	Custom Aggregate (Aberfoil)	Small	Markham	1	Markham	Medium
	Ethier Sand and Gravel Ltd.	Small	Sudbury	1	Sudbury	Medium
	Forwell Ltd.	Small	Kitchener	1	Kitchener	Medium
	Franceschini Bros. Aggregates (Ashland Oil Canada Ltd.)	Small	Mississauga	1	Mississauga	Medium

Pit Size

Small - 0-9 employees
Medium - 10-49 employees
Large - 50-99 employees
Very Large - over 99 employees

TABLE 6.7 (continued)
CHARACTERISTICS OF PROMINENT SAND AND GRAVEL SUPPLIERS IN QUEBEC AND ONTARIO

MARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATION	SIZE
Ontario	Giordano Sand and Gravel Ltd.	Small	Claremont	1	Claremont	Medium
	Gormley Sand and Gravel Ltd.	Medium	Gormley	1	Gormley	Large
	Hancock Sand and Gravel Co.	Small	Sunderland	1	Sunderland	Medium
	Highland Creek Sand and Gravel Co. Ltd.	Small	West Hill	1	West Hill	Medium
	J. C. Duff Ltd.	Small	Limehouse	1	Limehouse	Medium
	J. Chefero Sand and Gravel Ltd.	Small	Toronto	1	Toronto	Medium
	Johnson Bros. (Bothwell) Ltd.	Small	Bothwell	1	Bothwell	Medium
	Lee Sand and Gravel Ltd.	Small	Rexdale	1	Rexdale	Medium
	Lempiala Sand and Gravel Ltd.	Small	Thunder Bay	1	Thunder Bay	Medium
	Lockyer Brothers Limited	Small	Alton	1	Alton	Medium
	Ormell Sand and Gravel	Small	Fenelon Falls	1	Fenelon Falls	Medium

TABLE 6.7 (continued)
CHARACTERISTICS OF PROMINENT SAND
AND GRAVEL SUPPLIERS IN QUEBEC AND ONTARIO

MARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATION	SIZE
Ontario	Pagnutti Sand and Gravel Ltd.	Small	Sudbury	1	Sudbury	Medium
	Pinewood Aggregates Ltd.	Small	Peterborough	1	Peterborough	Medium
	Preston Sand and Gravel Company Limited	Small	Cambridge	1	Cambridge	Medium
	Spratt Sand and Gravel Ltd.	Small	Ottawa	1	Ottawa	Medium
	Springbank Sand and Gravel Ltd.	Small	Milton	1	Milton	Medium
	Standard Industries Ltd.	Medium (also crushed)	Markham	1	Markham	Medium
				1	North Bay	Medium
	Standard Aggregates (same as Standard Industries Ltd.)	Medium (large including above)	Markham	1	Guelph	Medium
				1	Stouffville	Medium
				1	Locust Hill-Pickering	Medium
				1	Mono	Small
				1	Paris East	Small
	Steed and Evans Limited	Small	Heidelberg	1	Heidelberg	Medium
	Superior Sand, Gravel, and Supplies Ltd.	Small	Maple	1	Maple	Medium

TABLE 6.7 (continued)
CHARACTERISTICS OF PROMINENT SAND AND GRAVEL SUPPLIERS IN QUEBEC AND ONTARIO

MARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATION	SIZE
Ontario	T.C.G. Materials Ltd.	Large	Brantford	1	Brantford	Medium
				1	Preston	Medium
				1	Forthill	Medium
				1	West Brantford	Small
				1	London	Medium
	T.R.T. Sand and Gravel	Small	Oono	1	Orono	Medium
	The Flintkote Company of Canada	Small	Oakville	1	Oakville	Medium

TABLE 6.8

CHARACTERISTICS OF PROMINENT CRUSHED ROCK SUPPLIERS IN QUEBEC AND ONTARIO

MARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATION	SIZE
QUEBEC (granite)	Carrière Hebert Inc.	Small	Rock-Forest	1	Rock-Forest	Medium
	Carrière Mt. Bruno	Small	St-Bruno	1	St-Bruno	Medium
	Continental Asphalte Inc.	Small	Shawinigan	1	Shawinigan	Medium
	Fairmont Granite Inc.	Small	Orford	1	Graniteville	Medium
	Granite Rose de Guenette	Small	Mt. Laurier	1	Guenette	Medium
	Intercomtes Construction	Small	Bromont	1	Bromont	Medium
	Les Carrières du Boulevard Inc.	Small	Baie Comeau	1	Baie Comeau	Medium
	Les Enterprises Ray-Car Inc.	Small	Thetford Mines	1	Thetford Mines	Medium
	Sintra Inc.		(see below)	1	St-Charles Cyrille Winceslas	Small

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Company Size

Very Small - Not listed
Small - 10-49 employees
Medium - 50-99 employees
Large - 100-199 employees
Very Large - over 199 employees
U - unknown

TABLE 6.8 (continued)

CHARACTERISTICS OF PROMINENT CRUSHED ROCK SUPPLIERS IN QUEBEC AND ONTARIO

MARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATION	SIZE
Quebec (lime-stone)	Beton Québec Inc.	Small	Charlesbourg Ouest	1	Charlevoix	Small
				1	Charlesbourg	Medium
	Canfarge Ltd Ltée	Large	Montréal	1	Francon	Large
				1	Legacé	
				1	St-Paul d'Abbotsford	Medium
	Carrière Bernier Lteé	Small	St-Jean	1	St-Jean	Medium
	Carrière de St-Barthelemy Ltée	Small	St-Bathelemy	1	St-Barthelemy	Medium
	Carrière Rioux and Frere Inc.	Small	Cowansville	1	Cowansville	Medium
	Carrières Lautentiénnes Inc.	Small	Ste-Thérèse	1	Ste-Thérèse	Medium
	Carrières Plessis Inc.	Small	Plessisville	1	Plessisville	Medium
	Carrières St-Eustache Ltée	Small	St-Eustache	1	St-Eustache	Medium

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Pit Size

Small - 0-9 employees
Medium - 10-49 employees
Large - 50-99 employees
Very Large - over 99 employees

TABLE 6.8 (continued)

CHARACTERISTICS OF PROMINENT CRUSHED ROCK SUPPLIERS
IN QUEBEC AND ONTARIO

MARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATION	SIZE
Quebec (lime-stone)	Ciment Independant	Medium	Montreal	1 1	Montreal Laval	Medium Medium
	Ciment St. Laurent Inc.	Small	Downsview, Ont.	U	U	U
	Claude Leduc Excavation Ltée	Small	Epiphante	1	Epiphante	Medium
	Compagnie Meloche Inc.	Small	Pointe-Claire	1	Pointe-Claire	Medium
	Corival Inc.	Small	Laval	1	Laval	Medium
	Gulf Canada Limited	Small	Montréal	1	Montréal	Medium
	La Carrière St-Francois Limitée	Small	St-Germain	1	St-Germain	Medium
	Les Carrières Calco	Small	St-Mark des des Carrieres	1	St-Mark des Carrieres	Medium
	Les Carrières de Dominique Limitée	Small	St-Dominique de Bagot	1	St-Dominique de Bagot	Medium
	Les Carrières Temis Inc. (Calcaire)	Small	Rviére Bleue	1	Riviére Bleue	Medium

TABLE 3
UNIT VALUE OF CRUSHED ROCK FOR END USES, LOUISIANA, 1983
("1983, U.S. Bureau of Mines and Minerals Yearbook")

Use	Unit Value, per Short Ton
Coarse aggregate (over 1.5 inch)	
Reprap and jetty stone	*
Coarse aggregate, graded	
Bituminous surface-treatment aggregate	*
Coarse and fine aggregate	
Graded road base or subbase	4.83
Unpaved road surfacing	3.27
Other	*
Agricultural	
Poultry grit and mineral food	*
Chemical and metallurgical	
Cement manufacture	2.70
Lime manufacture	*
Special: Other	5.12
AVERAGE	4.46

* Information withheld included in "Special: Other".

TABLE 4
USES FOR CRUSHED ROCK PRODUCED IN LOUISIANA, 1983
("1983, U.S. Bureau of Mines and Minerals Yearbook")

Use	Quantity M Short Tons	Percent
Coarse aggregate (over 1.5 inch)		
A Reprap and jetty stone	*	*
Coarse aggregate, graded		
Bituminous surface-treatment aggregate	*	*
Coarse and fine aggregate		
Graded road base or subbase	2.82	49.0
Unpaved road surfacing	1.28	22.2
Other	*	*
Agriculture		
Poultry grit and mineral food	*	*
Chemical and metallurgical		
Cement manufacture	0.25	4.3
Lime manufacture	*	*
Special: Other	1.41	24.5
TOTAL	5.76	100.0

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* Information withheld, included in "Special: Other"

TEXAS
SAND AND GRAVEL

Production:

Texas ranks second in the production of sand and gravel in the United States and accounts for about 10 percent of American production by value and 9 percent by volume.

In 1984, production in Texas was at 53.2 M short tons, down 9 percent from 1983 (58.5 M short tons) but up 17 percent from 1982 (45.5 M short tons).

The value of sand and gravel production was $195.2 M in 1984, accounting for 11 percent of the state's nonfuel mineral production. Value was down 6 percent from 1983 ($208.0 M) but up 26 percent from 1982 ($154.5 M).

In 1982, sand and gravel came from 154 pits in 73 counties. The leading counties were Colorado near Houston (11.1 M short tons, 23 percent of total), Dallas, Victoria (near Gulf coast), Travis, McLennan, Fayette (near Houston and Gulf coast), Denton, and Hidalgo. Each of the preceding counties produced over 1.0 M short tons.

Leading producers were:

Capital Aggregates of Austin and Del Rio;
The Fordyce Co. of Sullivan City and Victoria;
Gifford-Hill & Co. Inc. of Dallas (2), College Station, Washington, Waco and Boyd;
R.E. Jones Gravel Co. of Vealmore, Staton, and Abilene;
Lone Star Industries Inc. of Kleberg, Wibner, Altairs, Eagle Lake (dredge), Eagle Lake (pit), Garwood, Richmond, Lampasas, Dolen, and Maryneal;

Parker Bros. and Co. Ltd. of Houston (2), Victoria and Altair;
Texas Industries Inc. of Garwood, Ferris, Arlington, Eagle Lake, Tin Top, Denton, Austin, Dallas, Glen Rose, Lewisville, and Boyd;
Thorstenberg Materials Corp. of Ellinger and Garwood (2).

Value:

At $3.67 M per short ton, the annual unit value for sand and gravel was 3 percent higher in 1984 than for 1983 ($3.56).

The highest value end uses are asphaltic concrete, plaster and gunite sands, concrete aggregate, and road base and coverings, according to 1982 data.

End use values do not exhibit the pronounced variations in Texas as for other states (see Table 1).

Consumption:

The largest single use of sand and gravel is concrete aggregate according to 1982 data: over 70 percent of sand and gravel produced was used for concrete aggregate. Other uses are listed in Table 2.

TABLE 1
UNIT VALUE OF SAND AND GRAVEL PRODUCTS FOR END USES, TEXAS, 1982
("1982 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Unit Value, Per Short Ton
Asphaltic concrete	$3.74
Plaster and gunite sands	3.69
Concrete aggregate	3.62
Road base and coverings	3.60
Concrete products	3.36
Other	3.35
Railroad ballast	2.80
Snow and ice control	2.25
Average	$3.39

TABLE 2

PRINCIPAL USES OF SAND AND GRAVEL PRODUCED IN TEXAS, 1982

("1982 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Quantity M Short Tons	Quantity Percent
Concrete aggregate	32.59	71.6
Fill	5.36	11.8
Road base and coverings	3.11	6.8
Concrete products	2.12	4.7
Asphaltic concrete	1.65	3.6
Other	0.39	0.9
Plaster and gunite sands	0.31	0.7
Snow and ice control	*	*
Railroad ballast	*	*
Total	45.53	100.00**

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* Information withheld, included in "other"

** Total does not equal 100.0 due to rounding

CRUSHED STONE

Production:

Texas ranks first in crushed stone production in the United States and accounts for about 7 percent of the total value and 9 percent of the volume of production.

The crushed stone production in Texas in 1984 was 79.8 M short tons. This represented an increase of 4 percent over 1983 production (76.5 M short tons) and 17 percent over 1982 production (68.0 M short tons).

The value of 1984 production was $255.0 M. This was an increase of 6 percent over the 1983 value ($239.6 M) and 24 percent over the 1982 value ($205.0 M). Crushed stone represented 15 percent of the total nonfuel mineral production in the state.

Seventy-three of Texas' 254 counties produced crushed stone in 1983.

Over 90 percent of the stone quarried and crushed in the state was limestone or dolomite. Other rock types quarried include granite, marl, marble, sandstone, and traprock.

Over 110 companies produced crushed rock in 1983. The leading company in Texas and the United States was Texas Crushed Stone. The top four producers (Texas Crushed Stone, Gifford-Hill, Texas Industries Inc. and General Portland Inc.) accounted for 29 percent of the production and 24 percent of the value. The leading producers were:

General Portland Inc. of Chico;
Gifford-Hill and Co. Inc. of Midlothian, Allamore, Bridgeport;
Lone Star Industries of Bridgeport, Pasadena, Maryneal, Burnet;
Texas Crushed Stone Co. of Georgetown;
Texas Industries Inc. of Springtown, Ferris, Bridgeport, Georgetown;
Vulcan Materials Co. of San Antonio, Dennison, Chico, Bexar;
White's Mines Inc. of Brounwood, Parker County, Abilene, Dabney, Knippa; and
Parker Bros. and Co. Inc. (shell) of Seadrift (dredge), New Braunfels (dredge)

Value:

In 1984, the average unit value of crushed rock was $3.20 per short ton. This represented an increase of 2 percent over 1983 ($3.13) and 6 percent over 1982 ($3.01)

The highest value uses were fillers or extenders, roofing granules, lime manufacture, and terrazzo and exposed aggregate (see Table 3).

Consumption:

The largest uses for crushed stone are graded road base or subbase, coarse concrete aggregate, and cement manufacture. Other uses are illustrated in Table 4.

TABLE 3

UNIT VALUE OF CRUSHED ROCK FOR END USES

TEXAS, 1983

("1983 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Unit Value per Short Ton
Coarse aggregate (+1½ inch):	
Riprap and jetty stone	$4.41
Filter stone	4.05
Coarse aggregate, graded:	
Concrete aggregate, coarse	3.46
Bituminous aggregate, coarse	3.82
Bituminous surface treatment aggregate	4.97
Railroad ballast	3.28
Fine aggregate (-3/8 inch):	
Stone sand, concrete	3.63
Stone sand, bituminous mix or seal	3.38
Screening, undesignated	2.92
Coarse and fine aggregate:	
Graded road base or subbase	2.42
Unpaved road surfacing	2.99
Terrazzo and exposed aggregate	5.02
Crusher run, fill or waste	2.54
Combined coarse and fine aggregate	*
Agricultural:	
Agricultural limestone	2.28
Poultry grit and mineral food	*
Chemical and metallurgical:	
Cement manufacture	2.09
Lime manufacture	5.58
Sulfur oxide removal	2.24
Special:	
Other fillers or extenders	23.22
Roofing granules	15.64
Other[2]	3.77
Total	$3.13

TABLE 4
USES OF CRUSHED ROCK PRODUCED
IN TEXAS, 1983
("1983 US BUREAU OF MINES MINERALS YEARBOOK")

	QUANTITY	
Use	M Short Tons	Percent
Coarse aggregate (+1½ inch):		
Riprap and jetty stone	0.14	0.2
Filter stone	0.16	0.2
Coarse aggregate, graded:		
Concrete aggregate, coarse	11.58	15.1
Bituminous aggregate, coarse	2.40	3.1
Bituminous surface treatment aggregate	0.96	1.3
Railroad ballast	0.68	0.9
Fine aggregate (-3/8 inch):		
Stone sand, concrete	1.58	2.1
Stone sand, bituminous mix or seal	1.29	1.7
Screening, undesignated	1.15	1.5
Coarse and fine aggregate:		
Graded road base or subbase	23.36	30.6
Unpaved road surfacing	1.29	1.7
Terrazzo and exposed aggregate	0.09	0.1
Crusher run, fill or waste	1.64	2.1
Combined coarse and fine aggregate	*	*
Agricultural:		
Agricultural limestone	0.25	0.3
Poultry grit and mineral food	0.11	0.1
Chemical and metallurgical:		
Cement manufacture	9.53	12.5
Lime manufacture	1.18	1.5
Sulfur oxide removal	0.62	0.8
Special:		
Other fillers or extenders	0.58	0.8
Roofing granules	0.01	0.0
Other[2]	17.85	23.3
Total	76.45	100.0**

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* Information withheld, included in "Special: other"

** Total does not equal 100.0 due to rounding

QUEBEC
SAND AND GRAVEL

Production:

In 1982, Quebec produced 41.9M tonnes of sand and gravel, a 44 percent drop from 1981 (74.7M tonnes). Quebec was the third leading province in sand and gravel production, following Ontario and Alberta. It produced 19 percent of Canada's sand and gravel.

The value of 1982 producer's shipments was $66.1M, down 33 percent from 1981's value of $99.5.

Value was added to Quebec's sand and gravel through various operations in 1982, They included:

Washed and screened sand	1.1M tonnes
Screened sand	3.1
Gravel washed and screened	0.1
Screened gravel	4.2
Crushed gravel, washed and screened	0.4
Crushed gravel, screened not washed	10.9
Not processed	22.1

There were nineteen sand and gravel establishments in Quebec in 1982. The largest firms were:

Les Enterprises Loma Ltée, Beauport
Bédard Québec Inc., Loretteville
Sables Fournel, Prevost
Sables, L.G. Ltée, Prevoint
Sabliere Warwick Ltée, Arthabasca

Value:

The average unit value of sand and gravel in shipments in Quebec was $1.58 in 1982. This value represented an increase of 19 percent over the 1981 value of $1.33.

Consumption:

The primary end uses for sand and gravel produced in Quebec were road bed, surface and fill (see Table 1).

TABLE 1 - USES OF
SAND AND GRAVEL PRODUCED IN QUEBEC, 1982
(Census Canada, Quarries and Pits, 1982)

Use	Quantities	
	M Tonnes	Percent
Road bed, surface	25.64	61.1
Fill	7.72	18.4
Other special uses	3.69	8.8
Concrete Aggregate	3.04	7.3
Ice Control	0.79	1.9
Backfill for mines	0.60	1.4
Mortar sand	0.31	0.7
Railroad ballast	0.15	0.4
TOTAL	41.93*	100.0

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* Total does not equal 41.93 due to rounding.

QUEBEC
CRUSHED STONE

Production:

Including miscellaneous stone (riprap, roofing granules) 24.2M tonnes of crushed rock was produced in Quebec in 1982. In 1983, production was 27.1M tonnes, an 11 percent increase, and in 1984, it was 31.4M tonnes, a 16 percent increase. If chemical process stone and pulverized stone was added to the 1982 production, the sum was 24.9M tonnes. In 1982, Quebec was Canada's leading producer of crushed stone (including miscellaneous), representing 53 percent total production.

The value of production in 1982 was $88.7M including miscellaneous stone. Including chemical process stone and pulverized stone the value was $97.0M. Of that production, 79 percent was limestone, 15 percent was granite and 3 percent was sandstone.

In 1982, there were eighty quarries in Quebec producing stone products of various kinds. Among the largest companies were:

Canfarge Ltd/Lteè, Montreal, Iberville
Carrière Bernier Ltee, St Jean
Carrieres St-Eustache Lteè, Deux-Montagnes
Cement Indepenant Ltd., Montreal (2)
Claude Leduc Excavation Lteè, Ate. l'Assomption and St Marc de Carrieres
Compagnie Meloche Inc., Pointe-Claire
Corwal Inc., Lowal
Gulf Canada Limited, Montreal
Les Carrieres Calco, St Marc de Carrieres
Les Carrieres de Saint-Dominique Limiteè, St Dominique de Bagot
Mison Inc., Montreal
Pic Construction Co. Lteè, Jonquiere

Regional Construction Co. Inc., Beauharnois
River Mont Construction Ltd., Chateauguay
Sintra Inc., Chateauguay, St-Isidore, Berthier, Granby, Joliette
Verreault Frontenace Inc., Limoilou (2)

Value:

The average unit value for crushed stone (including miscellaneous uses) shipments was $3.66 per tonne. With chemical process stone and pulverized stone included, the average unit value was $3.90 per short tonne. Detailed unit value information for individual end uses was not available.

Consumption:

Consumption data for 1984 is presented in Tables 2 and 3.

TABLE 2 - USES OF CRUSHED STONE PRODUCED IN QUEBEC, 1984
(QUEBEC, MINISTERE DE L'ENERGIE ET DES RESOURCES)

Use	Quantities M Tonnes	Quantities Percent
Construction uses	23.7	75.5
Bituminous aggregate	1.8	5.7
Concrete aggregate	5.9	18.8
Total	31.4	100.0

TABLE 3 - CONSUMPTION BY PARTICLE SIZE, CRUSHED STONE PRODUCED IN QUEBEC, 1984

Size	Quantities M Tonnes	Quantities Percent
Fine aggregate (less than or equal to 20 mm)		
- 6 mm	1.12	3.4
- 14 mm	2.18	6.9
- 20 mm	2.97	9.4
- 0-6 mm	2.25	7.2
- 0-20 mm	12.07	38.4
Fine and medium aggregate		
- 0-40 mm	2.29	7.3
Fine to coarse aggregate		
- 0-70 mm	4.66	14.8
- 0-80 mm	0.28	0.9
Other	3.62	11.5
Total	31.43*	100.0**

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* Total does not equal 31.43 due to rounding.

** Total does not equal 100.0 due to rounding.

COST COMPONENTS FOR SAND AND GRAVEL OPERATIONS, QUEBEC (1982)

(Statistics Canada, Quarries and Pits, 1982)

Components	Total	Unit per tonne	Percent of shipment Value
Salaries and wages			
- mining	$ 1.6	0.04	2.5
- other	0.7	0.02	1.3
Fuel and electricity	1.5	0.04	2.5
Materials and supplies	1.9	0.05	3.2
Value of production	11.0	0.26	16.5
Shipment value	66.1	1.58	100.0

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* Number of employees:

Mining = 84
Other Production = 0
Other = 35

COST COMPONENTS FOR CRUSHED STONE OPERATIONS, QUEBEC (1982)

(Statistics Canada, Quarries and Pits, 1982)

Components	Total**	Unit Per tonne	Percent of Shipment Value
Salaries and wages			
- mining	$ 17.0	0.68	16.3
- other	4.6	0.18	4.3
Fuel and electricity	9.9	0.40	9.6
Materials and supplies	24.7	0.99	23.8
Value of protection	88.4	3.54	85.1
Shipment value	103.9	4.16	100.0

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* Number of employees:

Mining = 755
Other Production = 1
Other = 217

** Includes dimensional, chemical process, pulverized, miscellaneous and crushed stone (25.0M tonnes).

ONTARIO
SAND AND GRAVEL

Production:

Ontario's production of sand and gravel was 62.3M tonnes in 1982. This represented a decrease of 24 percent from 1981 production of 77.5M tonnes. Ontario was the leading Canadian producer of sand and gravel, accounting for 29 percent of total production.

The value of 1982 production was $156.5M, up 8 percent from 1981 ($145.6M).

Of the 1982 production, various portions received some processing as shown below:

Washed and screened	6.0M tonnes
Screened sand	6.0
Gravel washed & screened	0.7
Screened gravel	1.5
Crushed gravel, washed & screened	5.9
Crushed gravel, screened not washed	12.1
Not processed	28.8

In 1982, there were 56 sand gravel pits in Ontario. Leading producers were:

Ambro Materials and Construction Ltd., Brampton,
Burnside Sand and Gravel and Burnside Aggregates, Nepean,
Caledon Sand and Gravel Ltd., Toronto,
Ethier Sand and Gravel Ltd., Barrie,
Forwell Ltd., Kitchener
Franceschini Bros. Aggregates, Mississauga
Gormley Sand and Gravel Ltd., Gormley
Hancock Sand and Gravel, Sunderland

Highland Creek Sand and Gravel Co. Ltd., West Hill
J. Chefero Sand and Gravel Ltd., Toronto
Johnson Bros (Bothwell Ltd.), Bothwell
Springbank Sand and Gravel Ltd., Milton
Standard Industries Ltd. of Markham and North Bay
Standard Aggregates of Markham, Guelph, Stouffville, Locust Hill - Pickering, Mono, and Paris East
T.C.G. Materials Ltd. of Brantford, Preston, Fonthill, West Brantford, Brantford, and London

Value:

The average unit value of sand and gravel in Ontario in 1982 was $2.51 per tonne. This represented an increase of 34 percent over the 1981 unit value of $1.88 per tonne.

Consumption:

The primary end uses for sand and gravel in Ontario are road beds and surfaces and fill, according to 1982 information (see Table 1).

TABLE 1
USES OF
SAND AND GRAVEL PRODUCED IN ONTARIO, 1982
(Census Canada, Quarries and Pits, 1982)

Use	Quantities M Tonnes	 Percent
Road bed, surface	34.46	57.1
Concrete aggregate	9.27	15.4
Fill	7.29	12.1
Other special uses	5.33	8.8
Ice control	1.83	3.0
Mortar sand	0.87	1.4
Railroad ballast	0.78	1.3
Backfill for mines	0.56	0.9
TOTAL	60.37*	100.0

* Total does not equal 60.37 due to rounding.

ONTARIO
CRUSHED STONE

Production:

A total of 18.9M tonnes of crushed stone - including miscellaneous stone (riprap, roofing granules) was produced in Ontario in 1982. If chemical process stone (flux and lime) and pulverized stone (agricultural limestone) were included the production was 20.0M tonnes. Ontario was Canada's second leading producer of crushed stone (including miscellaneous), accounting for 39 percent of total production.

The value of 1982 production (including miscellaneous) was $79.8M - $87.0 including chemical process stone and pulverized stone.

In 1982, there was 24 stone quarries in Ontario, some of which produced dimension stone.

Leading producers were:

Beachvilime Limited, Ingersoll
Dufferin Aggregates, Downsview
King Paving and Materials Ltd., Oakville
Standard Industries Ltd. of Haldimand, Brechin, and Point-Anne.
Steetley Industries Ltd. of Dundas and Niagara Falls.

Value:

The 1982 average unit value for crushed stone (including miscellaneous uses) shipments was $4.22 per tonne. Including chemical process stone and pulverized stone the average unit value was $4.35 per tonne.

Consumption:

Unfortunately, detailed consumption data was unavailable for Ontario. However, consumption data for Canada is presented in Table 2.

TABLE 2
USES OF CRUSHED ROCK PRODUCED IN CANADA

(Statistics Canada, "Quarries and Pits", 1982)

	Quantity	
Use	M Tonnes	Percent
Crushed aggregate	4.47	9.6
Asphalt aggregate	4.09	8.8
Road material	16.15	34.6
Railway ballast	1.31	2.8
Other	20.62	44.2
TOTAL	46.64	100.0

COST COMPONENTS FOR
SAND AND GRAVEL OPERATIONS, ONTARIO (1982)
(Statistics Canada, Quarries and Pits, 1982)

Component	Total	Unit Per Tonne	Percent of Shipment Value
Salaries and wages *			
- mining	$ 14.4M	$ 0.23	9.2
- other	6.5	0.10	4.0
Fuel and electricity	8.6	0.14	5.6
Materials and supplies	16.2	0.26	10.4
Value of production	64.5	1.04	41.4
Shipment value	156.5	2.51	100.0

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* Number of employees:

Mining = 650
Other Production = 4
Other = 343

COST COMPONENTS FOR
CRUSHED STONE OPERATIONS, ONTARIO (1982)
(Statistics Canada, Quarries and Pits, 1982)

Component	Total**	Unit Per Tonne	Percent of Shipment Value
Salaries and wages*			
- mining	$ 13.2M	0.65	14.8
- other	5.6	0.28	6.4
Fuel and electricity	6.2	0.31	7.1
Materials and supplies	15.7	0.78	17.8
Value of production	59.5	2.94	67.1
Shipment value	88.5	4.38	100.0

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* Number of employees:

Mining = 541
Other Production = 29
Other = 181

** Includes dimensional, chemical process, pulverized, miscellaneous and crushed stone (20.2M tonnes).

TABLE 6.8 (continued)

CHARACTERISTICS OF PROMINENT CRUSHED ROCK SUPPLIERS IN QUEBEC AND ONTARIO

MARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATION	SIZE
Quebec (lime-stone)	Les Construction Deschêne Ltée	Small	Aylmer Est	1	Aylmer Est	Medium
	Miron Inc. (Calcaire)	Small	Montréal	1	Montréal	Medium
	P. Baillargeon Ltée	Small	IbervilleW	1	Iberville	Medium
	Pagé Construction Inc.	Small	Trois-Rivières	1	Trois Rivières	Medium
	Pic Construction Co. Ltée	Small	Arvida	1	Arvida	Medium
	Regional Construction Co. Inc.	Small	St-Louis-De-Gonzague	1	St-Louis-DeGonzague	Medium
	River Mont Construction Ltd.	Small	Chateauguay	1	Chateauguay	Medium
	Simard-Beaudry Inc.	Small	Montréal	1	Montréal	Medium
	Sintra Inc.	Medium	Granby	1 1 1	St-Isidore Berthier Joliette	Medium Small Medium
	Union de Carrières et Pavages Ltée	Small	Charlesbourg	1	Charlesbourg	Medium
	Verreault Frontenac Inc.	Small	Limoilou	1 1	Verreault Charlesbourg	Medium Medium

TABLE 6.8 (continued)

CHARACTERISTICS OF PROMINENT CRUSHED ROCK SUPPLIERS
IN QUEBEC AND ONTARIO

MARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATION	SIZE
Quebec (marble)	A. Langlois & Fils	Small	Thetford Mines	1	Thetford Mines	Medium
	Les Marbles Waterloo Ltée	Small	Stukely Sud	1	Stukely Sud	Medium
Quebec (other)	Les Carrières Ducharme Inc.	Small	Hemmingford	1	Hemmingford	Medium
	Sintra Inc.	Medium	Granby	1 1	St-Jean-Chrysostome Princeville St-Valère	Medium Medium
	J.M. Langlois Inc.	Small	Laprairie	1	Leprairie	Medium
Ontario (lime-stone)	Amherst Quarries (1969) Ltd.	Small	Amherstberg	1	Amherstberg	Medium
	Ambro Materials and Construction Ltd.	Small	Brampton	1	Brampton	Medium
	Beachvilime Limited	Large	Ingersoll	1	Ingersoll	Very Large
	Canfarge Lte/Ltée	Medium	Montréal	1	Ottawa	Medium
	Dufferin Aggregates	Medium	Downsview	1	Downsview	large
	Dunnville Rock Products Ltd.	Small	Dunnville	1	Dunnville	Medium
	Flamboro Quarries Ltd.	Small	Dundas	1	Dundas	Medium

TABLE 6.8 (continued)

CHARACTERISTICS OF PROMINENT CRUSHED ROCK SUPPLIERS IN QUEBEC AND ONTARIO

MARKET	COMPANY			PITS		
	NAME	SIZE	LOCATION (HEAD OFFICE)	NUMBER	LOCATION	SIZE
Ontario (lime-stone)	Indusmin Limited/ Limitée	Medium	Toronto	1	Milton	Medium
				1	Halton Hills Acton	Medium
	King Paving & Materials Ltd.	Large	Oakville	1	Oakville	Very Large
	McKean Quarries Limited	Small	Collingwood	1	Collingwood	Medium
	Port Colborne Quarries Ltd.	Small	Port Colborne	1	Port Colborne	Medium
	Ridgemount Quarries Ltd.	Medium	Thorold	1	Thorold	Medium
	Standard Industries Ltd.	Medium (including sand and gravel)	Markham	1 1 1	Haldimand Brechin Point-Anne	Medium Medium Medium
	Steetly Industries Ltd.	Large	Hamilton	1 1	Dundas Queenston	Very Large Small
	Vineland Quarries and Crushed Stone Ltd.	Small	Thorold	1	Thorold	Medium
	Willroy Mines Limited	Small	Milton	1	Milton	Medium

TABLE 6.9 - SIZE DISTRIBUTION OF SAND AND GRAVEL AND CRUSHED ROCK SUPPLIERS IN THE UNITED STATES

Market	Material	Number of Suppliers				
		Very Large	Large	Medium	Small	Total
Quebec	Sand and gravel	-	-	-	5	5
	Crushed stone	-	1	2	39	42
Ontario	Sand and gravel	-	1	3	31	35
	Crushed stone	-	3	4	10	17

In 1977 as a percentage of "shipment value":

"Value added in mining" ranged from 65.6 to 75.2

- "payroll expense" ranged from 17.5 to 31.1
- "supplies expense" ranged from 35.2 to 47.0
- "inventories" ranged from 4.1 to 14.3

As a percentage of "gross value" of depreciable assets:

- "buildings and other" ranged from 2.2 to 14.0
- "machinery, equipment" ranged from 71.5 to 90.4
- "mineral exploration" ranged from 0.2 to 5.3
- "mineral lands and rights" ranged from 2.0 to 10.7

Ratio of shipment value to depreciable assets ranged from 0.74 to 1.02.

Within some of the ranges there were some differences:

- percentage of "payroll expense" was lower for producers of crushed and broken granite and for all producers located in southern states.

- percentage of "inventories" was lower for sand and gravel producers, higher for producers of crushed and broken granite.

- percentage of assets in "buildings and other" was higher for both sand and gravel produces and those producers located in northern states.

- percentage of assets in "machinery, equipment" was higher for producers of crushed and broken granite and producers located in southern states.

TABLE 6.10

FINANCIAL STATUS OF CRUSHED ROCK AND SAND AND GRAVEL PRODUCERS BY SELECTED STATES, 1977
(1977 CENSUS OF MINERAL INDUSTRIES)

Item	Crushed and Broken Limestone						Crushed and Broken Granite						Sand and Gravel					
	Pennsylvania		Florida		Texas		Virginia		North Carolina		Georgia		New York		Texas		Louisiana	
	Value,$M	%	Value,$M	%	Value,$M	%	Value,$M	%	Value,$M	%	Value,$M	%	Value,$M	%	Value,$M	%	Value,$M	%
Value of shipments	141.4	100.0	53.9	100.0	47.8	100.0	36.0	100.0	58.2	100.0	75.6	100.0	41.2	100.0	110.0	100.0	46.2	100.0
Value added in mining	92.7	65.6	38.3	71.1	33.8	70.7	25.5	70.8	40.1	68.9	50.1	66.2	31.0	75.2	74.7	67.9	32.8	71.0
Expenses:																		
- Payroll, all employees	43.6	30.8	12.1	22.4	11.8	24.7	7.5	20.8	11.5	19.8	13.2	17.5	12.8	31.1	26.6	24.2	12.6	27.3
- Supplies (incl. fuel, power, machinery, minerals and other)	66.4	47.0	23.6	43.8	17.1	35.8	14.7	40.8	26.7	45.9	34.0	45.0	14.5	35.2	48.8	44.4	19.1	41.3
Inventory, products:																		
- Beginning of year	17.0	12.0	5.5	10.2	5.3	11.1	4.9	13.6	7.3	12.5	12.7	16.8	5.0	12.1	7.2	6.5	2.3	5.0
- End of year	18.5	13.1	4.5	8.3	5.5	11.5	4.2	11.7	8.3	14.3	12.0	15.9	5.0	12.1	5.4	4.9	1.9	4.1
Gross value of depreciable assets:	189.1	100.0	55.9	100.0	46.7	100.0	39.4	100.0	78.3	100.0	94.2	100.0	49.9	100.0	115.1	100.0	40.5	100.0
- Buildings and other	21.3	11.3	3.3	5.9	2.1	4.5	4.0	10.2	1.7	2.2	2.2	2.3	7.0	14.0	9.5	8.3	3.7	10.9
- Machinery, equipment	152.2	80.5	45.8	81.9	39.9	85.4	32.5	82.5	70.8	90.4	83.3	88.4	35.7	71.5	90.4	78.5	31.7	78.3
- Mineral exploration	4.7	2.5	1.0	1.8	0.1	0.2	2.1	5.3	0.2	0.3	1.3	1.4	2.4	4.8	2.9	2.5	2.0	4.9
- Mineral land and rights	10.9	5.8	5.7	10.2	4.6	9.9	0.8	2.0	5.6	7.2	7.4	7.9	4.8	9.6	12.3	10.7	3.1	7.7
Ratio of Shipment Value to Depreciable Assets	0.75		0.96		1.02		0.91		0.74		0.80		0.83		0.96		0.88	

- percentage of assets in "mineral lands and rights" was higher for sand and gravel producers.

Most of the variation in percentage of assets allocated to "mineral lands and rights" and "mineral exploration" is likely due to variations in the mines and minerals legislation among the states.

6.3.2 Quebec and Ontario

While not as extensive as information on American producers, Canadian data indicates that the aggregate industry in Quebec and Ontario is structured similarly to that in the United STates (see Table 6.11). Examples of the similarities include:

As a percentage of "shipment value":

- "Value added in mining" ranged from 60.9 to 69.1 versus 65.6 to 75.2 in the United States

- "Payroll expense" ranged from 20.9 to 32.4 versus 17.5 to 31.1 in the United States

- "Supplies expense" ranged from 30.9 to 39.1 versus 35.2 to 47.0 in the United States.

It appears, therefore, that aggregate producers across North America face the same production cost composition. However, any New Brunswick or Nova Scotia producer which had reduced expenses could enjoy a competitive advantage in the marketplace.

TABLE 6.11

FINANCIAL STATUS OF CRUSHED ROCK AND SAND AND GRAVEL PRODUCERS IN QUEBEC AND ONTARIO, 1982

	Crushed Stone				Sand and Gravel			
	Quebec		Ontario		Quebec		Ontario	
Item	Value, $M	%	Value, $M	%	Value, $M	%	Value, $M	%
Value of production	88.4	100.0	59.5	100.0	11.0	100.0	64.5	100.0
Value added in mining	53.8	60.9	37.6	63.2	7.6	69.1	39.6	61.4
Expenses:								
- Payroll, all employees	21.6	24.4	18.8	31.6	2.3	20.9	20.9	32.4
- Supplies (incl. fuel, power, machinery, minerals and other)	34.6	39.1	21.9	36.8	3.4	30.9	24.8	38.4
Change in inventory (both crushed rock and sand and gravel	Quebec = $2.9M Ontario = $2.5M							

6.4 Tariffs

There is no tariff on sand and gravel imported into the United States. The applicable tariff is 513.14, and applies to both Most Favoured Nations (MFN) and NonMFN. Tariff changes planned for January 1, 1987 will not alter the status quo.

The tariff status for crushed rock is unknown at this time.

7.0 TRENDS IN PRODUCTION

7.1 United States - Short-Term

7.1.1 New England

Because of the severity of the recession of the early 1980s, it is difficult to project long-term construction trends for New England. However, some changes are large enough and have occurred for long enough to warrant close inspection.

- Despite some production upturn in 1983 and 1984, production levels in the 1980s are well below those of the 1970s. For example, aggregate production in Massachusetts averaged about 23 M tonnes in the 1970s; in the 1980s it has averaged 18 M tonnes.

- In the densely populated states of Massachusetts, Rhode Island and Connecticut, aggregate production has shifted from sand and gravel to crushed stone. For example, in Connecticut the mixture was 47 percent sand and gravel and 53 percent crushed rock in 1980, it was 45 percent sand and gravel and 55 percent crushed rock in 1982, and it was 40 percent sand and gravel and 60 percent crushed rock in 1984.

7.1.2 Middle Atlantic

As for New England, the Middle Atlantic states suffered through a recession in the early 1980s, making it difficult to project long-term trends. Some findings:

- Production seems to have remained steady or grown slightly through the 1980s. For example, production in New York was 44.5 M tonnes in 1981 and 47.7 M tonnes in 1984.

- The mixture of sand and gravel and crushed stone favours crushed stone especially in New York (62-64 percent), Pennsylvania (79-81 percent), Maryland (61-65 percent), and Virginia (83-84 percent). The proportion of crushed stone to sand and gravel seems to be increasing in New Jersey and Pennsylvania.

7.1.2 South Atlantic

The "Sun Belt" including the South Atlantic states did not suffer as badly from the early 1980s recession as the rest of the United States. The entire "Sun Belt" is in the midst of an economic boom which is reflected in aggregate production:

- In all four South Atlantic states production has increased from 1981 to 1984: North Carolina by 18 percent, South Carolina by 11 percent, Georgia by 26 percent, and Florida by 3 percent. These increases occurred despite production drops in 1982.

- All four states have an aggregate mixture predominated by crushed stone: 82-86 percent in North Carolina, 74-75 percent in South Carolina, 90-92 percent in Georgia, and 78-81 percent in Florida. In North Carolina crushed stone is becoming more predominant (1981, 82 percent - 1984, 86 percent), while in Florida sand and gravel is becoming more predominant (1981, 19 percent - 1984, 22 percent).

7.1.3 Gulf of Mexico

As part of the Sun Belt, the four states of Alabama, Mississippi, Louisiana, and Texas experienced a less severe recession in the 1980s than the northern United States.

However, aggregate producers in Alabama and Mississippi did experience some drop in demand in 1982, 1983 and 1984 with the completion of the Tennessee-Tombigbee waterway. As well, aggregate demand in Louisiana was affected by the 1984 New Orleans World's Fair.

Some trends:

- Texas experienced substantial growth in aggregate production in the 1980s from 108 M tonnes in 1981 to 120 m tonnes in 1984 (11 percent). Growth in the other three states was not as strong.

- The aggregate mixture favoured sand and gravel in Mississippi (85-87 percent) and Louisiana (71-74 percent), crushed stone in Alabama (69-75 percent) and Texas (57-61 percent). The mixtures seem to be stable in all four states.

7.1.4 Discussion

This brief analysis illustrates key points about the aggregate market in the United States.

1. The mixture of aggregate materials is shifting towards crushed stone. It appears that the main reason for this shift is that developable deposits of sand and gravel are becoming more scarce. Sand and gravel is much cheaper to produce than crushed stone, and therefore would have its reserves depleted first.

   The implications of this shift are significant. Crushed stone is more expensive than sand and gravel and has a higher energy component. It is easier for a New Brunswick or Nova Scotia supplier of either sand and gravel or crushed stone to compete in a crushed stone market. This trend, therefore, improves the market situation for export.

2. The differential growth in aggregate production and consumption favours the Gulf of Mexico and South Atlantic markets which, are growing faster than the Middle Atlantic and New England markets. The New England market appears to be stagnant. (1)

7.2 United States - Long-Term

7.2.1 Changes in Supply

Environmental Pressures. A significant long-term trend affecting aggregate production is the growing strength of the environmental lobby. Environmental concerns have affected existing and proposed aggregate operations including:

- dredging of river sediments (sand and gravel) in Pennsylvania (restricted);
- dredging of oyster shells (crushed stone) in Louisiana (moratorium);
- wet-processing of sand and gravel near wet lands in Maryland (prohibited).

Removing aggregates from rivers, lakes or seashores can alter the ecosystem: creating muddy shoals in place of the gravel beds which are spawning areas for many fish species, for example. As well, wet processing or washing of sand and gravel releases silt which can soil streams and bury vegetation. Such alterations are not welcomed by environmentalists or the public at large. As a result of past problems, aggregate producers will be monitored more carefully in the future. It is likely that fewer sites will be approved for exploitation and that environmental controls will become more restrictive.

At the 1984 meeting of the Operations Division of the National Crushed Stone Association held in Hartford, CT, one delegate gave a presentation on the considerations necessary to design a waste disposal procedure at a rock quarry. In his opinion, a ten-year lead time was not long when the various hydrogeological, operations, regulatory and public relations factors were considered.

The environmental trend enhances the market potential for aggregates produced in New Brunswick and Nova Scotia, as American producers will be forced to use more distant sites with consequent higher costs for transportation and environmental protection.(2)

Land Use Conflicts. Another significant trend is the increasing occurrence of land use conflicts among real estate developments, farms, watersheds (surface and ground water supplies), parks, and mines. The conflict is particularly acute in the densely populated strip of land running from Portland, Maine through to Norfolk, Virginia. This strip includes eastern Massachusetts (Boston), Rhode Island, Connecticut, southern New York (New York City), northern New Jersey, southeastern Pennsylvania (Philadelphia), Delaware, eastern Maryland (Baltimore), Washington, D.C., and eastern Virginia. Another location with conflicts is southern Florida.

When land use conflicts occur, mining usually receives a low priority, especially for a low value commodity such as aggregate. Examples:

- There have been no rock quarries in Delaware since 1968. More and more aggregate is imported as it has become increasingly difficult to expand or develop the state's aggregate resources.

- Several Maryland operators have faced protests from nearby residents. Complaints have included property damage from blasting, proximity of pits and quarries to residences, and increased truck traffic.

- Crushed stone operators in Loudown and Roanoke Counties, Virginia have had expansion plans opposed by residents.

- The Readington Township Committee in Hunterdon County, New Jersey voted unanimously (1983) for a three-year moratorium on mineral exploration, drilling and extraction. A land purchase by a producer in nearby West Amwell Township generated considerable opposition.

- Pennsylvania operators faced opposition in Cumberland and Berks Counties.

- National and state parks in Pennsylvania, Maryland, and North Carolina were expanded recently, removing large areas of land from potential production.

Land use conflicts will continue to increase as urban areas grow. This trend, too, enhances the market potential for New Brunswick and Nova Scotia producers, as it tends to make the number of developable American deposits distant, and more expensive to develop. (3)

Competition--European Ownership. An interesting trend of recent years is the takeover of American aggregate producers by large European firms. Examples include the purchase of Barrett Paving Materials (operations in seven northeast states) by Colas of Paris, France in 1979, the expansion of Genstar (a Canadian-Belgian corporation) throughout the United States, and the sale by Lone Star Industries Inc. of its Florida aggregate, ready-mix, and concrete block plants to Tarmac PLC of Wolverhampton, England. This trend appears to be part of a widespread investment in American industry by nonAmericans. It is not known if this is a truly long-term trend.

It is difficult to determine how this trend will affect market potential. The new owners could introduce innovative, perhaps, more efficient production methods from overseas; this would reduce market attractiveness for Maritime producers. On the other hand, the "absentee" owners could lose touch with their American operations and allow them to deteriorate, which would improve market attractiveness. A third possibility is that the American subsidiaries could serve as beachheads for the import of aggregates from the owner's home country. This scenario seems improbable, especially for imports from Europe. Overall, this would tend to be a somewhat detrimental trend for Maritime importers.

Competition--increased corporate concentration, reduced market competition. This trend is already apparent and should become more pronounced in the future. Factors promoting the trend include the greater capital costs required to develop pits and quarries, (due to equipment costs and environmental and land use conflicts) and the potential efficiencies of scale from larger, more integrated operations.

Concentration occurs in two directions. Horizontal concentration is the replacement of many small, independently-owned aggregate operations with a few, large operations in the same market area. The larger firms grow at the expense of the smaller ones.

Vertical integration refers to the integration of operations by one owner from "cradle to grave" eliminating independent ownership of intermediate operations. A good example is a firm which produces aggregate, manufactures cement, and produces ready-mix concrete. Because of American anti-trust legislation, there are limits to the extent of corporation integration and concentration allowed, but several firms have attained a high level of integration and concentration.

Corporate concentration tends to be greater in the South Atlantic and Gulf of Mexico markets (Vulcan Materials Co., Florida Rock Industries Inc.). Vertical integration tends to be higher there as well, with several large firms extracting aggregates and making products with them (Gilford Hill and Co. Inc., Lone Star Industries Inc., Ideal Basic Industries).

This trend will tend to reduce the attractiveness of the market to Maritime producers. Large firms have more resources and influence to counter a marketing thrust than smaller firms. However, large firms can be inflexible and vulnerable in small market segments (or niches); for example, a large firm might allow an importer to sell riprap in a market rather than go through the time and expense of converting a plant for a short production run. As well, a large firm may be willing to strike a deal with an importer and have the importer supply part of its market share.

The difficulties which can face a large firm are well illustrated with the recent difficulties of Ideal Basic Industries. This company has experienced extreme financial problems as the result of tough competition and mismanagement. (4)

Reduction in slag production. Where available, slag is often used as a low-cost aggregate source. However, with the decline in the steel industry in the United States slag production has decreased, especially in Pennsylvania, Delaware, and Alabama. This trend enhances market attractiveness for New Brunswick and Nova Scotia producers. (5)

Increase in flyash consumption. Flyash is a by-product of coal burning and is produced in very large quantities by electric utilities. The United States Environmental Protection Agency (EPA) through its Resource Recovery and Conservation Act (RRCA) is promoting the use of flyash as a cement and aggregate substitute.

Acceptance of the idea has been slow. However, since 1975 Georgia has used 2.3 million cubic metres of flyash concrete for pavement and shoulders on its highways. This trend could significantly reduce the consumption of aggregates, especially in coal mining (and burning) states like Pennsylvania, Virginia and Alabama. (6)

Safety and health. In the 1980-83 period, 300 deaths and 47 000 nonfatal injuries occurred in the mining industry. The United States Mine Safety and Health Administration (MSHA) is trying to reduce these figures and is proposing regulations to increase mine safety.

Several of the proposed regulations would affect aggregate producers including: revisions to loading, hauling and dumping regulations, brake testing for all vehicles capable of traveling faster than 16 kph, and reinforcement of cab roofs on front-end loaders and bulldozers. All these changes would increase operations costs and improve the cost relationship for Maritime producers. (7)

Environmental Legislation. Several new environmental regulations could affect American aggregate producers. Underground fuel storage tanks have become a predominant concern of the Environmental Protection Agency (EPA). Now only "tanks made of noncorrosive material, cathodically protected steel, clad with a noncorrosive material, or tanks designed to prevent releases of stored substances" will be accepted. Owners of existing tanks will have to report them to state officials. In 1987, rules on tank testing and replacement will be released.

It is estimated that new tanks cost between $5.00-$8.00 per litre of capacity and tank repair $2.00 per litre--an additional cost of doing business.

The EPA in 1980 released new regulations regarding dust control from crushers, bucket elevators, and grinders. Wet suppression systems are permitted.

A new EPA handbook will downplay the impact on communities from aggregate dust. This should make pit and quarry expansion easier. (8)

Reserve depletion tax benefit. At present, American aggregate producers from a tax benefit called "percentage depletion". It allows producers to deduct 5 percent of total income as a result of depleting their resource. The benefit is of particular importance in states where strong environmental public opinion and laws make exploration costs high. New York is one such state.

In recent years, the Democratic party has proposed reduction or elimination of percentage depletion, the Republican party has favoured retention or slight reduction in the benefit.

If percentage depletion were eliminated, American producers would pay much more tax and Maritime producers receive a substantial market enhancement. (9)

Technological developments. Several recent developments have had the goals of improving and expanding the mining of aggregates:

(a) A study investigated the potential for mining and marketing offshore sand and gravel deposits off of the coast of southern California. Analyses showed that a mining and processing vessel handling 1.0 M tonnes per year could be economic (1982).

(b) Automation and computer controls are being introduced for many pits, quarry, and processing operations.

(c) Improved blasting techniques allow quarries to be operated safely in congested areas.

(d) Increased use of geophysical techniques for mapping overburden. Recent advances have reduced cost, increased speed and expanded the range of geophysical mapping. (10)

Improved crushing methods. Studies have shown that cubical-shaped aggregates offer several advantages, in concrete. The advantages include better workability, higher strength, better mixing, better consistency, reduced cement required, and easier finishing of concrete. Improved crushing can yield more cubical aggregate from the quarry resulting in a more efficient use of material and better prices for the operator.

This trend will allow all producers, Maritime and American, to become more efficient and realize better prices. Overall, the trend could reduce market opportunities for Maritime firms by prolonging the life of American reserves. (11)

Increased long distance marketing. As a result of the increased size of operations, more operators are looking at larger market areas, especially if inexpensive transportation is available. A good example is the Tower Rock Stone Co. operation at Ste. Genevieve, MO. There, almost 95 percent of the 3.0 M tonne annual production is transported by barge along the Mississippi River system to locations in Illinois, Louisiana, Mississippi, Missouri, Tennessee, Texas and Florida. Tower Rock has developed these markets as part of a three-phase expansion plan implemented in 1979.

This trend can enhance or reduce market opportunities for Maritime producers. Opportunities are enhanced when the Maritime producers compete against higher cost producers which must transport their product by truck or rail. However, producers like Tower Rock which have easy access to boat transport have advantages of proximity and cost over Maritime producers, especially in the Gulf of Mexico market area. (12)

7.2.2 Changes in Demand.

More renovation of buildings and civil structures. Because of rising costs for new construction, many owners of buildings, wharves, bridges, and roads are renovating existing structures and a higher proportion of construction funds are being diverted to renovation work.

Renovations require much less aggregate for foundations and concrete, so this trend diminishes market potential for New Brunswick and Nova Scotia producers by reducing the market size.

Economic growth-location. Predicting where long-term growth will occur is difficult. It is a function of population shifts, resource availability, infrastructure, climate, political, technological, social, labour, and overall economic conditions. Here are some general trends:

- Portland, ME is presently growing at a rate faster than most of New England.

- Cambridge, MA has become a center for high technology research and development.

- Areas of Connecticut, New York, and Pennsylvania are suffering from a decline in heavy industry (steel, foundries).

- The peripheral areas of New York City are prospering due to their proximity to New York's amenities and distance from its nuisances.

- New Jersey is experiencing a sustained boom, especially in the north.

- Baltimore is experiencing a renaissance in its downtown.

- The Virginia coast is enjoying a construction "boom".

- As part of the "Sun Belt" all the South Atlantic and Gulf of Mexico states are experiencing a higher rate of growth than the rest of the United States. Specific examples include:

  . Portions of Texas, especially Houston and Dallas, are growing more rapidly than the rest of the United States, and are expected to continue growing into the long-term.

  . Florida is expected to continue its high rate of growth past the year 2000, especially the Gulf coast.

  . Atlanta, GA has experienced above-average growth since the 1970s, and is forecast to experience growth into the long-term. (13)

Public Works. In 1982, the United States government raised the gasoline tax by five cents per gallon with four cents allocated to highway improvements. In turn, three cents of the tax is dedicated to highway rehabilitation. As a result, the Federal Highway Administration (FHA) spends almost $15B on highway work every year--the largest American public works programme. This expenditure will continue indefinitely.

The second largest public works programme is the Environmental Protection Agency's (EPA) sewage treatment grant programme. At present, the EPA distributes $2.48B every year for projects across the United States. There is now some conflict in the American Government about how long the EPA grants will continue:

the Administration wishes to spend only $6B more, spread out until 1990, while the Congress wishes to continue the $2.4B annual grants until 1994.

Infrastructure has become a primary concern in the United States as many experts are warning of severe malfunctions in road, water and sewer systems unless they are repaired and upgraded.

To this end, some legislators have proposed a National Infrastructure Act which would distribute $3B annually to states for infrastructure rehabilitation and construction. (14)

Increased use of soil cement. Soil cement is a mixture of natural soils, portland cement, and water, which is being used increasingly for slope protection, seepage control, foundation stabilization and pipe bedding. All these applications use aggregates or concrete at present, so the increased use of soil cement will reduce demand for aggregates. (15)

Technological developments. Because of the low price and widespread availability of aggregates, many attempts have been made to extend their application. In the last few years, several discoveries and technological innovations have created opportunity for increased aggregate use, including:

(a) high-quality mineral fibres from basalt;

(b) glass fibres from a 50-50 mixture of limestone and slate. These fibres have good alkali resistance and could replace asbestos in reinforcing concrete;

(c) use of limestone for sulfur dioxide control in coal-burning power plants and pulp and paper mills.

(d) a Texas firm has developed "Quazite", a new construction material which can be precast or cast-in-place. Consisting of graded aggregate and high-performance polymers and monomers, this composite material has high bending strength, good chemical resistance, and dialectric properties.

On the other hand, some technological advances could displace aggregates from traditional uses:

- a Dutch firm has patented a granular material, composed of flyash, boiler ash, sea sand, lime, and other materials, can be used as a substitute for gravel in concrete. (16)

Recycling. Utilization of recycled materials has become increasingly common, particularly in highway construction. The major factor in increased use of recycled materials is reduction in cost. In the past, primary interest in asphaltic concrete recycling was to reuse the asphalt cement due to its increasingly high cost, with a reduction in new aggregate as a side benefit. Now in aggregate deficient areas, reuse of aggregates provide significant economic benefits as well. In general, recycled asphaltic concretes have been used mainly in the base asphalt course of resurfaced roads. Recycled aggregate commonly amounts to roughly 50 percent of the total. The final surface course is usually virgin material. A recent study prepared for the Ministry of Natural Resources, Ontario, predicts aggregate consumption for resurfacing will drop by 50 percent. In general, reduction in aggregate use for asphalt paving in Canada is presently in the range of 10-20 percent in those Provinces currently recycling (Ontario, Quebec, New Brunswick). Falling crude oil prices and potentially lower asphalt cement prices could reduce the economic viability of asphalt recycling in the short-term. (17)

Portland Cement Concrete. There has been interest in recent years in crushing existing concrete and reusing as aggregate in new concrete or as road base material, etc. In this case, the economics of using recycled concrete as aggregate are based on the costs of obtaining virgin aggregates. In general, a ratio in the order of 50 percent recycled coarse aggregate and 50 percent virgin aggregate has been used, although some road paving projects have been completed using 100 percent recycled aggregate.

In major urban areas such as New York City, which are deficient in aggregates, commercial recycling of concrete is becoming more common. In addition to being economically competitive with virgin aggregate, use of recycled materials also reduces cost of disposal of building and construction rubble. In New York City the cost of recycled concrete aggregate is about two-thirds the cost of virgin aggregate barged from Connecticut and upriver Hudson points. (18)

Alternative Materials. In recent years, there has been a tremendous increase in use of synthetic materials in road construction, slope stabilization, etc., primarily in the form of filter materials or as reinforcing. Alternative filter materials displace sands and crushed stone. Synthetic reinforcing materials reduce the amounts of aggregates required for a given level of design strength. In both cases, economics dictate the selection of synthetic materials or natural aggregates. In general these alternative materials would not seriously impact on anticipated demand for high value crushed stone used in asphalt or portland cement concrete.

See Table 7.1.

7.3 Canada

Many of the factors affecting short- and long-term aggregate markets in Canada are similar to those in the United States and have the same effect. There are some uniquely Canadian factors, however, and they will be described below.

Legislation. In 1983-84 Ontario introduced a new Planning Act which incorporated important provisions regarding the aggregate industry. Under the Act, municipal plans are required to protect existing pits and quarries and to identify and preserve untapped reserves for future use. These provisions are controversial and have been criticized by environmental and agricultural interests. (19)

Reserves. Reserve depletion could occur by the 1990s in some areas of Canada. If this occurs, consumers in those areas will have to pay higher prices for aggregates and suppliers will have to obtain their supplies from distant pits or quarries, underground mines, or underwater deposits. (20)

See Table 7.1.

TABLE 7.1

DESCRIPTIVE SUMMARY OF SHORT-TERM AND LONG-TERM TRENDS ON AGGREGATE MARKETS

(Legend: + means enhancement of market for Maritime producers
- means lessening of market for Maritime producers
o means minimal or no effect on market potential)

	NEW ENGLAND					MIDDLE ATLANTIC						SOUTH ATLANTIC				GULF OF MEXICO				CANADA	
Trend	ME	NH	MA	RI	CT	NY	NJ	PA	DE	MD	VA	NC	SC	GA	FL	AL	MS	LA	TX	PQ	ON
SHORT-TERM																					
- shift to crushed stone	o	o	+	+	+	o	+	+	o	o	o	+	o	o	o	o	o	o	o	+	+
- market growth	-	-	-	-	-	+	o	o	+	+	+	+	+	++	o	o	o	+	+	o	o
SUMMARY	-	-	o	o	o	+	+	+	+	+	+	++	+	++	o	o	o	+	+	+	+
LONG-TERM																					
Changes in supply																					
- environmental pressures	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	++	+	+	+
- land use conflicts	+	+	++	++	++	++	++	++	+++	++	++	+	+	+	++	+	+	+	+	+	+
- competition - European ownership	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	o	o
- competition - increased concentration	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- reduction in slag production	+	+	+	+	+	+	+	++	++	+	+	+	+	+	+	++	+	+	+	o	+
- increase in flyash consumption	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- safety and health	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
- environmental legislation	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
- reserve depletion tax benefit*	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	o	o
- technological developments	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
- improved crushing methods	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- increased long distance marketing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* In United States only

TABLE 7.1 (continued)

DESCRIPTIVE SUMMARY OF SHORT-TERM AND LONG-TERM TRENDS ON AGGREGATE MARKETS

	NEW ENGLAND					MIDDLE ATLANTIC						SOUTH ATLANTIC				GULF OF MEXICO				CANADA	
Trend	ME	NH	MA	RI	CT	NY	NJ	PA	DE	MD	VA	NC	SC	GA	FL	AL	MS	LA	TX	PQ	ON
SUMMARY	++	++	+++	+++		+++	+++	++++	+++++	+++	+++	++	++	++	+++	+++	++	+++	++	+	++
Changes in Demand																					
- more renovation, less new construction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- economic growth	+	o	+	o	o	+	++	o	+	+	+	+	+	++	++	+	+	+	++	+	++
- public works	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
- increased use of soil cement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- technological developments	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
- recycling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SUMMARY	o	-	o	-	-	o	+	-	o	o	o	o	o	+	-	o	o	o	+	o	+
OVERALL LONG-TERM SUMMARY	++	+	+++	++	++	+++	++++	+++	+++++	+++	+++	++	++	+++	++++	+++	++	+++	+++	+	+++

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8.0 ESTIMATES OF SHORT-TERM AND LONG-TERM DEMAND

8.1 Introduction

For this report, both short-term and long-term trends were projected. "Short-term" was defined as the 1985 to 1989 period, while "long-term" was defined as the period until 2005.

Short-term trends were projected based upon studies done elsewhere. In particular, the United States projections are based upon information selected from the publications "1985 U.S. Industrial Outlook" supplied by the United States Department of Commerce, and "Sand and Gravel", "Stone", and "Crushed Stone" (1981, 1982, 1983 and 1984 editions) supplied by the United States Bureau of Mines. Canadian projections are based upon information drawn from Statistics Canada (specifically catalogue 26-224); "Stone" and "Mineral Aggregates" from Energy, Mines and Resources Canada; "Report on the Nation, 1986" by The Financial Post and "Mineral Aggregate Transportation Study" by the Ontario Ministry of Natural Resources.

Long-term trends were developed based upon the researchers' assessment of market growth and developed from a review of short-term trends and the evaluation presented in Section 7.0.

It should be noted that all dollar-based projections are based on constant dollars except where noted.

8.2 United States

8.2.1 Short-Term

8.2.1.1 Past Trends - Sand and Gravel

From a low of 535.0 M tonnes in 1982, American sand and gravel production has increased steadily through the 1980s (see Table 8-1).

8.2.1.2 Past Trends - Crushed Stone

Like sand and gravel production, American crushed stone production hit a low in 1982 and has risen steadily since then (see Table 8.2).

Projecting growth in the short-term requires an analysis of key demand components for sand and gravel including highway construction, building construction, concrete production, concrete products production, and disposable income.

8.2.1.3 Highway Construction

For the short-term, it is projected that American expenditures on new highway construction and operation will increase slowly but steadily at 1.4 percent and 1.9 percent per annum respectively until 1989 (see Figure 8.1). In the United States, government expenditures apportioned to highway work is partially funded through a dedicated gasoline tax, thus making expenditures quite predictable. In the short-term, emphasis will be placed on repair and upgrading of highways rather than new construction.

TABLE 8.1
SAND AND GRAVEL PRODUCTION IN THE UNITED STATES
(1977-1986)*

Year	United States		New England (excluding VT)		Middle Atlantic		South Atlantic		Gulf of Mexico	
	Production (tonnes)	Growth (%)	Production (tonnes)	Growth (%)	Production (tonnes)	Growth (%)	Production (tonnes)	Growth (%)	Production (tonnes)	Growth (%)
1978	867.8	-	-	-	-	-	-	-	-	-
1979	851.8	- 1.8	-	-	-	-	-	-	-	-
1980	687.4	-19.3	-	-	-	-	-	-	-	-
1981	622.0	- 8.3	29.1	-	54.0	-	26.8	-	75.0	-
1982	535.0	-14.0	26.1	-10.2	50.9	- 5.7	24.1	- 9.9	70.8	- 5.6
1983	590.0	10.3	22.7	-13.0	54.5	7.1	26.6	10.4	83.2	17.4
1984	697.0	18.1	32.3	42.5	66.8	22.5	35.6	30.0	91.8	10.3
1985	725.0	4.0	-	-	-	-	-	-	-	-
1986	740.0	2.1	-	-	-	-	-	-	-	-

* Figures for 1977 to 1984 are from U.S. Bureau of Mines Minerals Handbook, 1985 and 1986 estimates are from Rock Products, December 1985.

FIGURE 8.1

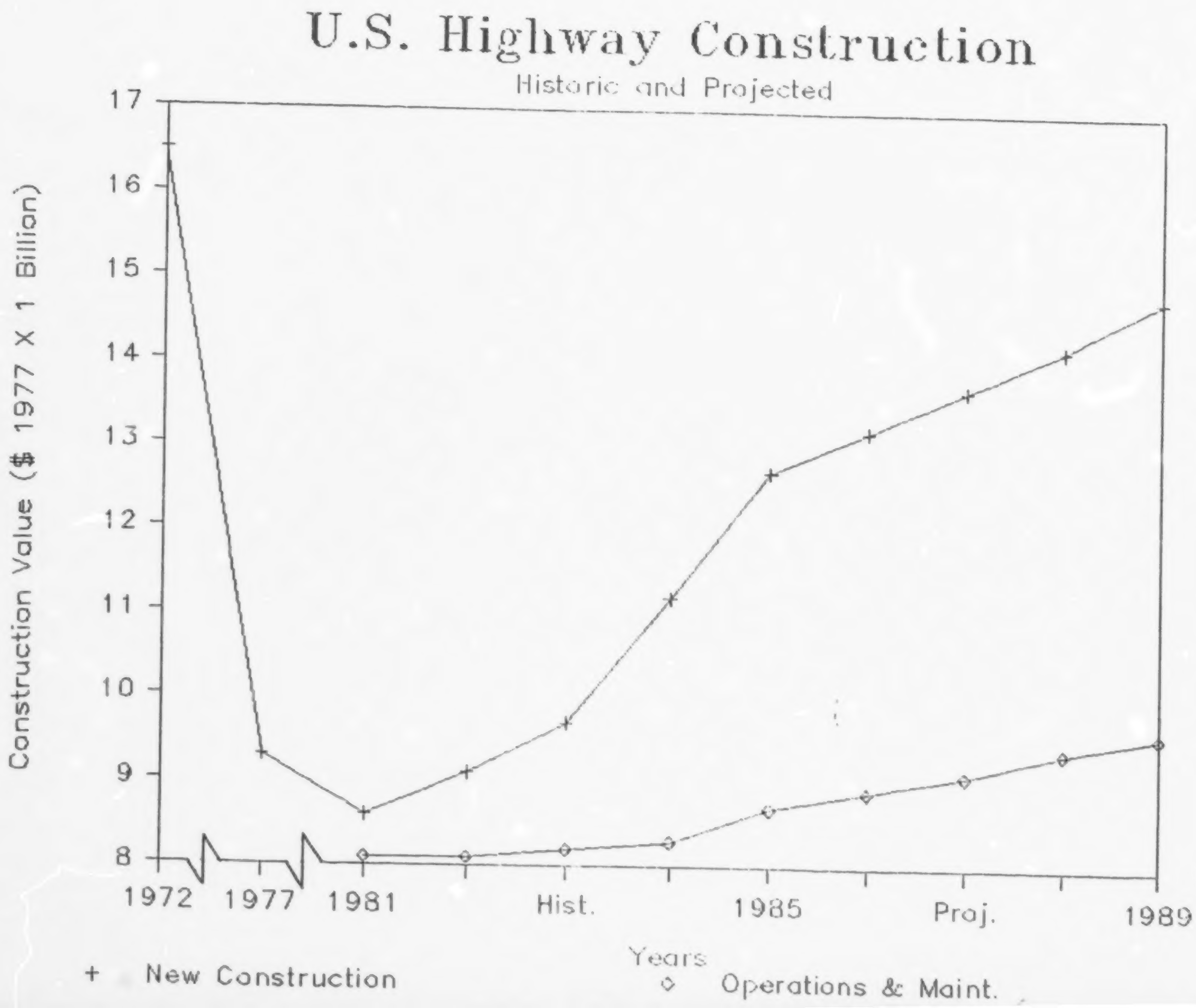

U.S. Highway Construction
Historic and Projected
Construction Value ($ 1977 X 1 Billion)
17
16
15
14
13
12
11
10
9
8
1972
1977
1981
Hist.
1985
Proj.
1989
Years
+ New Construction
◇ Operations & Maint.

TABLE 8.2

CRUSHED STONE
PRODUCTION IN THE UNITED STATES (1977-1986)*

Year	United States		New England (excluding VT)		Middle Atlantic		South Atlantic		Gulf of Mexico	
	Production (t)	Growth, (%)	Production (t)	Growth, (%)	Production (t)	Growth, (%)	Production (t)	Growth (%)	Production (t)	Growth (%)
1977	859.5 M	-	-	-	-	-	-	-	-	-
1978	945.0	9.9	-	-	-	-	-	-	-	-
1979	999.5	5.8	-	-	-	-	-	-	-	-
1980	886.0	-11.4	15.5	-	154.0	-	142.3	-	90.0**	-
1981	786.1	-11.3	15.3	- 1.1	133.3	-13.4	130.1	- 8.6	84.0**	- 6.7
1982	711.7	- 9.5	13.4	-12.3	126.2	- 5.3	129.4	- 0.5	80.4**	- 4.3
1983	776.2	9.1	16.4	22.4	137.9	9.3	133.2	2.9	94.1	17.0
1984	861.3	3.3	17.9	9.3	155.0	12.4	153.5	15.2	105.7	12.3
1985	890.0	3.3	-	-	-	-	-	-	-	-
1986	945.0	6.1	-	-	-	-	-	-	-	-

---

*Figures for 1977 to 1984 are from U.S. Bureau of Mines Minerals Handbook, 1985 and 1986 estimates are from Rock Products, December 1985. The estimate of growth for 1986 by Pit and Quarry is (January 1986) 2.0 percent.

**Production for Mississippi and Louisiana withheld.

Highway construction uses for aggregate include:

sand and gravel:
- concrete aggregate
- asphaltic concrete aggregates and other bituminous mixtures
- road base and coverings
- fill
- snow and ice control
- other uses

crushed stone:
- coarse agregate, over 1.5 inch
    - macadam
    - riprap and jetty stone
- coarse aggregate, graded
    - concrete agregate
    - bituminous aggregate
    - bituminous surface - treatment
- fine aggregate, under 0.375 inch
    - concrete stone sand
    - bituminous mix or seal stone sand
- coarse and fine aggregate
    - graded road base and subbase
    - unpaved road surfacing
    - crushed run or fill or waste
- chemical and metallurgical
    - cement manufacture
- special
    - asphalt fillers or extenders

8.2.1.4 Building Construction

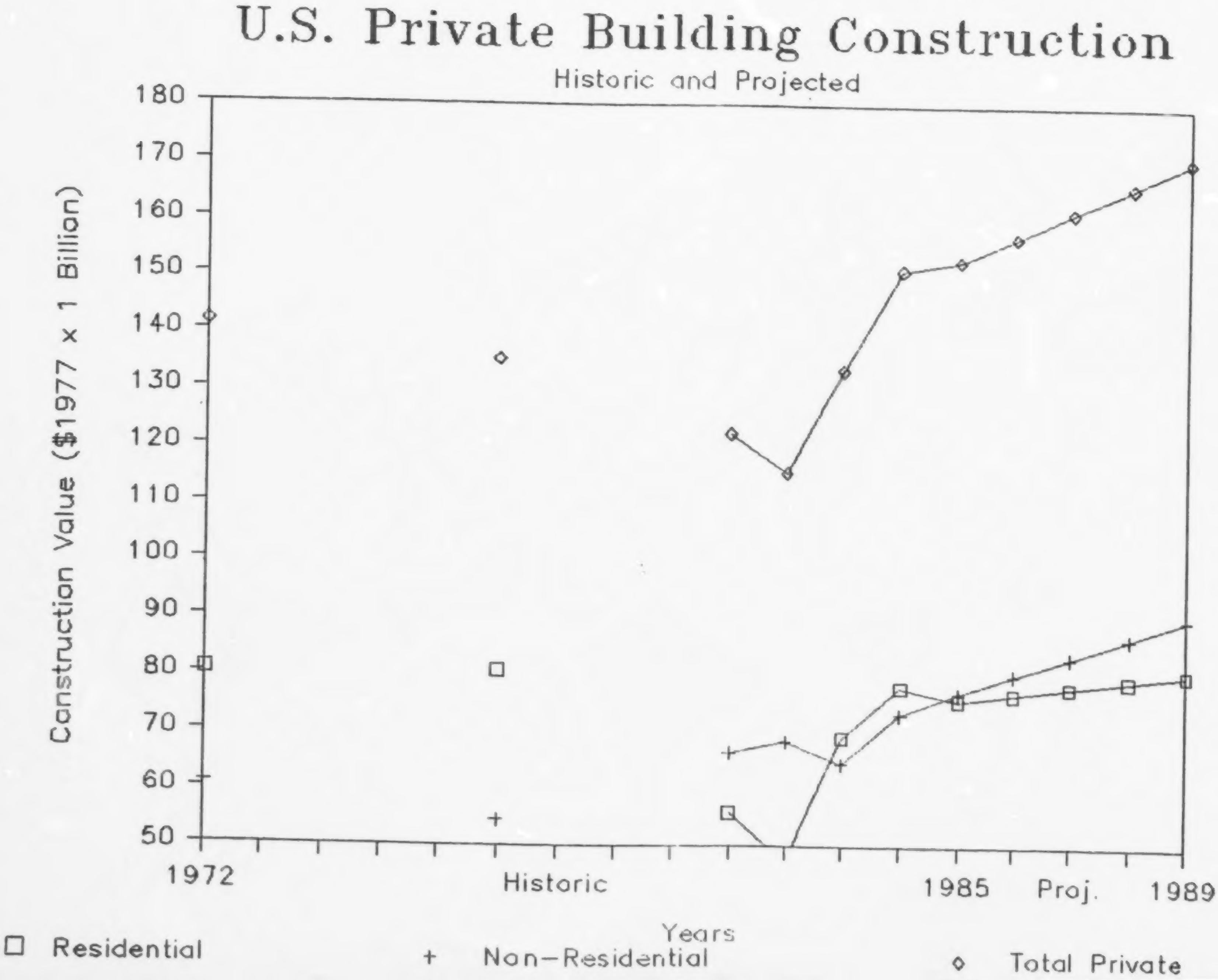
A healthy construction industry is projected until 1989 with residential construction anticipated to grow at 1.5 percent per annum and nonresidential construction at 4.0 percent per annum. The combined rate is forecast at 2.8 percent per annum (see Figure 8.2).

Building construction uses aggregates for various uses including:

sand and gravel:
- concrete aggregate
- concrete products
- plaster and gunite sands
- fill
- other uses

crushed stone:
- coarse aggregate, graded
  - concrete aggregate
- fine aggregate, under 0.375 inch
  - concrete stone sand
- coarse and fine aggregate
  - terrazzo and exposed aggregate
  - crush run or fill or waste
  - other coarse and fine aggregate
- chemical and metallurgical
  - cement manufacture
- special
  - roofing granules

FIGURE 8.2


U.S. Private Building Construction
Historic and Projected
Construction Value ($1977 x 1 Billion)
180
170
160
150
140
130
120
110
100
90
80
70
60
50
1972
Historic
1985
Proj.
1989
Years
□ Residential
+ Non-Residential
◇ Total Private

8.2.1.5 Concrete and Concrete Products Production

Heavily dependent upon highway and, especially, building construction industries, concrete and concrete products production is projected to grow at a rate of 2.4 percent per annum until 1989 (see Figure 8.3).

Aggregate types used for concrete and concrete products production include:

sand and gravel: concrete aggregate
concrete products

crushed stone: coarse aggregate, graded
- concrete aggregate

fine aggregate, under 0.375 inch
- concrete stone sand

chemical and metallurgical
- cement manufacture

8.2.1.6 Disposable Income

For this report disposable income was selected as an indicator for two reasons: (1) it has a good correlation to construction activity; and (2) trends are available on a regional basis.

Short-term disposable income projections (until 1989) are 1.6 percent per annum for New England, 0.8 percent per annum for the Mid Atlantic and 2.0 percent per annum for the South Atlantic States (see Figure 8.4). It is likely that building construction growth will exhibit similar growth differences among the three regions.

FIGURE 8.3

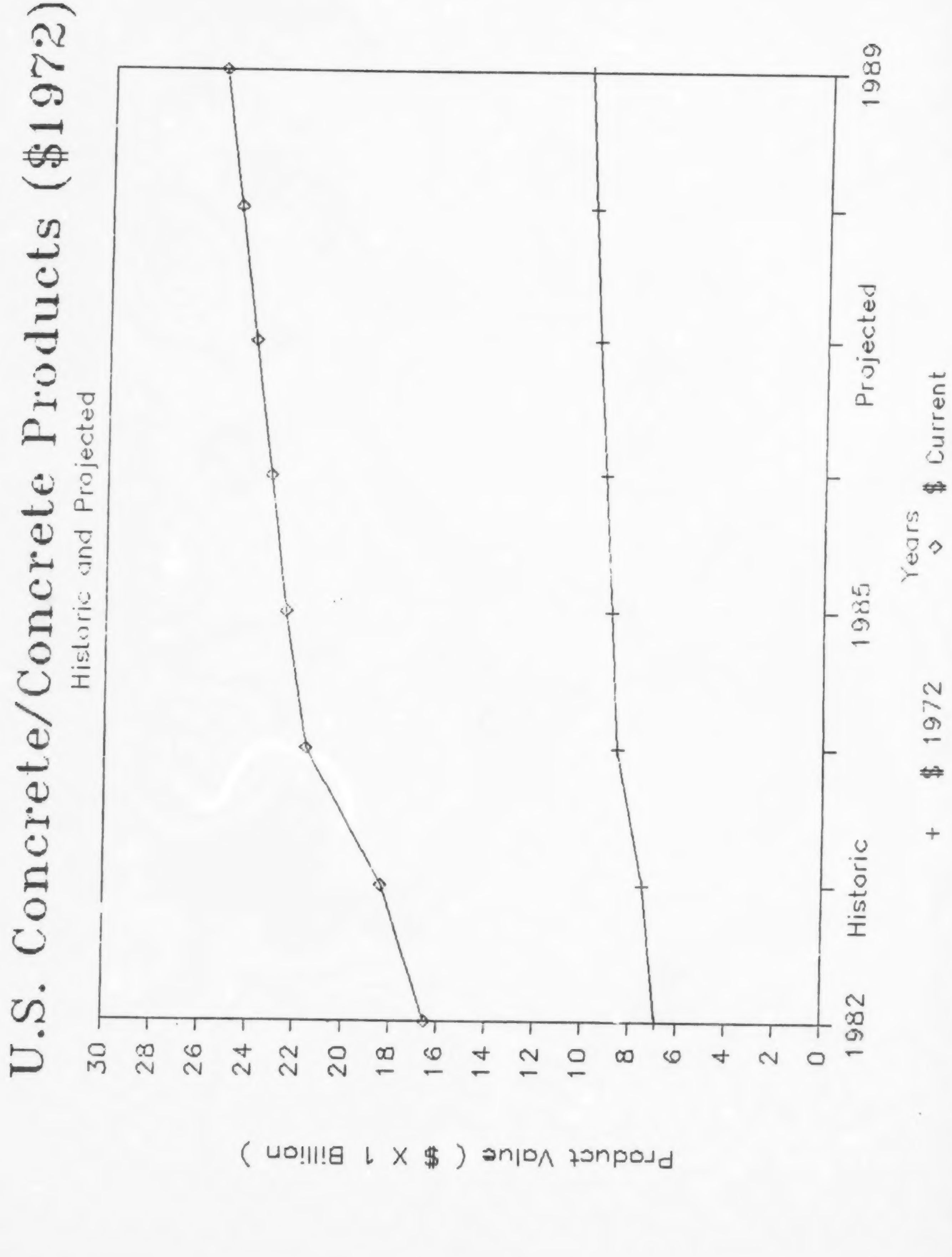
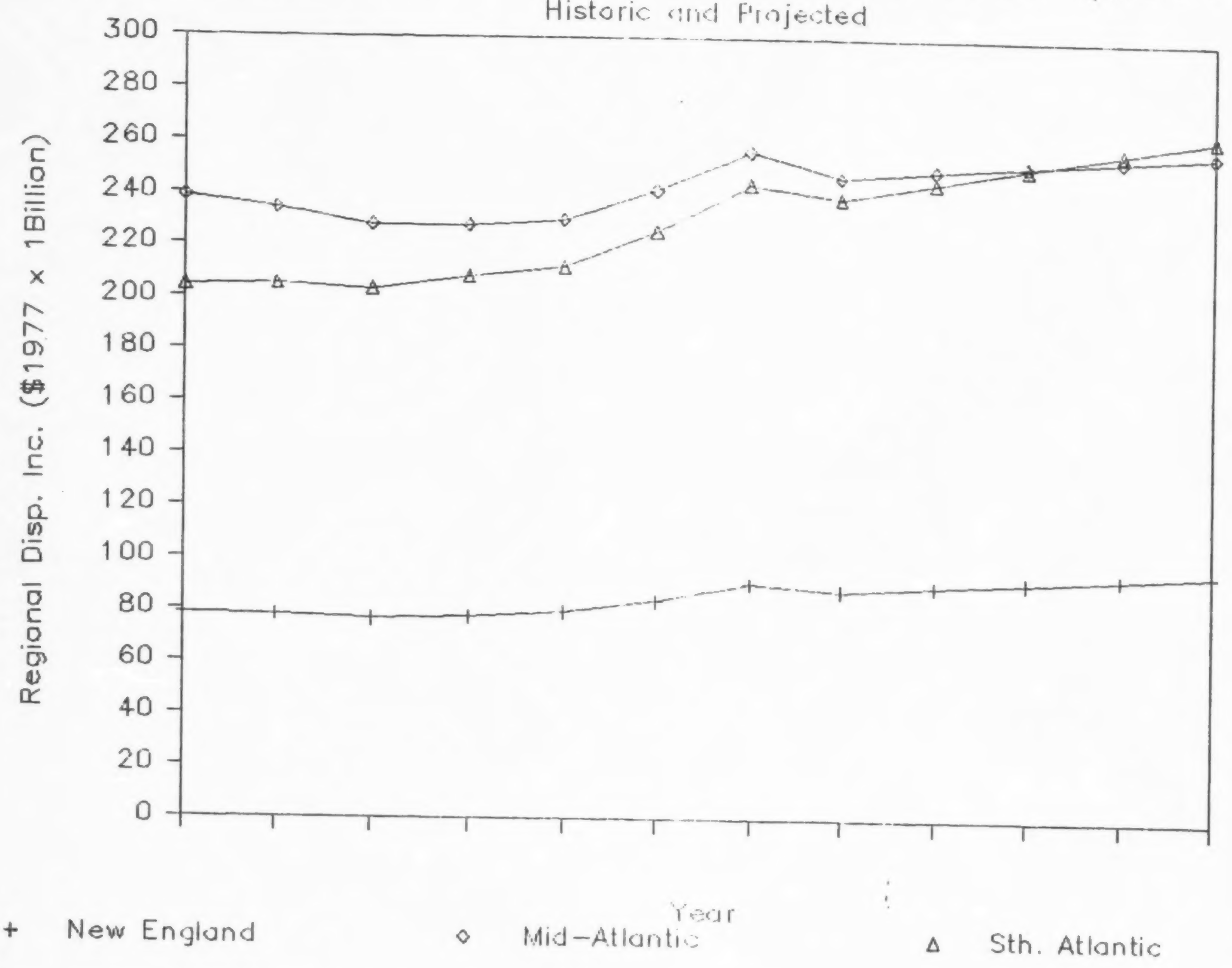

U.S. Concrete/Concrete Products ($1972)
Historic and Projected
Product Value ($ X 1 Billion)
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
1982
1985
1989
Historic
Projected
Years
+ $ 1972
◇ $ Current

FIGURE 8.4

U.S. Regional Disposable Income ($1977)

Historic and Projected



8.2.1.7 Evaluation

In the short-term, the U.S. market appears healthy but not booming. If a New Brunswick or Nova Scotia producer can secure a market share in the United States, it should be able to maintain and increase that share, other factors being constant (example $1 (Cdn) = $1.40 (U.S.), low shipping prices, little U.S. protectionism). While it appears that New England and the South Atlantic states hold the most promise, there is strong variation among states. New York, for example, appears to be a prime market in the short-term.*

8.2.2 Long-Term

Being dependent on construction, aggregate demand is very cyclical as witnessed by the changes in demand through the 1970s and 1980s (see Tables 8.1 and 8.2). Aggregate is a low-value commodity which is commonly found and is easily produced. The line of production from raw to finished product is typically very short with relatively little intermediate processing or transportation involved. As a result, contracts are usually short and when downturns or upturns occur in the economy, aggregate producers respond quickly.

Thus, while aggregate demand is projected to grow with the economy, the growth will exhibit peaks and valleys which could make business difficult for a New Brunswick or Nova Scotia supplier in the American market.

Within the trend of long-term growth, several other developments will affect aggregate demand. Among the negative developments for aggregate demand are the trend toward a mixture of more renovation and less new construction, increased use of soil cement for civil projects, recycling of aggregates, and the use of synthetic materials in geotechnical projects. Among the positive develoments are the increased public awareness of the need for repairing and upgrading infrastructure, and development of new products which use aggregate as raw material.

Since aggregates are cheap it is doubtful that they will be replaced by other material; actually the reverse could happen. However, demand could be reduced by better construction techniques such as recycling. It is likely that the two trends (more uses, less consumed per use) will balance each other, resulting in a future aggregate demand quite similar to existing demand. For purposes of this report, a long-term growth of 1.5 percent per annum has been forecast until 2005, yielding a production of 2236 M tonnes in that year (sand and gravel plus crushed stone).

8.3 Canada

8.3.1 Short-Term

8.3.1.1 Past Trends - Sand and Gravel

Unlike that of the United States, Canadian production has had flat growth in the 1980s. By province, the flat trend is more pronounced with Ontario production showing low growth and Quebec production decreasing growth (see Table 8.3).

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* The January 1986 issue of "Pit and Quarry" interviewed officials of several state aggregate associations and found that New York producers were projecting 5-10 percent growth per annum over the next five years, Pennsylvania looked promising for the next six years, Virginia and North Carolina were optimistic and Texas reported mixed conditions.

TABLE 8.3

SAND AND GRAVEL PRODUCTION IN CANADA
(1982-1984)
(Energy, Mines and Resources)

	Canada		Quebec		Ontario	
Year	Production	Growth	Production	Growth	Production	Growth
1982	216.3	-	41.9	-	62.3	-
1983	233.4	7.9%	37.0	-11.7	68.3	9.6
1984	220.6	-5.4%	30.5	-17.6	65.3	-4.4

One reason for the low growth of sand and gravel production appears to be displaced or replaced by crushed stone. Why the displacement is occurring is not known for certain. It is likely due to depletion of good quality sand and gravel deposits within easy access of markets, since crushed stone is generally more expensive than sand and gravel.

8.3.1.2 Past Trends - Crushed Stone

There has been a steady growth in crushed stone production in Canada since 1982. The growth has been especially strong in Ontario, with Quebec having experienced slower growth (see Table 8.4). Part of this growth seems to be the result of displacement or replacement of sand and gravel.

8.3.1.3 Highway Construction

In constant dollars Canadian highway construction expenditures hav remained flat or decreased in the 1970s and 1980s (see Figure 8.5). Current dollars tell a different, somewhat distorted story (see Figure 8.6).

Quebec's highway construction peaked in the mid-1970s and has decreased in current dollars expenditures through the 1980s. The level of construction has dropped significantly since 1979 and the trend appears to be continuing. However, it is likely that the trend will reach a minimum value soon, as there is a minimum level of operation and maintenance which must be maintained. When this minimum level will be reached is not known, but is should occur before 1989. Trend line projections are unreliable for government expenditures.

TABLE 8.4

CRUSHED STONE PRODUCTION IN CANADA
(1982-1984)

Year	Canada*		Quebec*		Ontario*	
	Production (k tonnes)	Growth (%)	Production (k tonnes)	Growth (%)	Production (k tonnes)	Growth (%)
1982	53.32	-	22.58	-	21.25	-
1983	60.86	14.1	24.60	8.9	25.08	18.0
1984	64.01	5.2	25.44	3.4	26.58	6.0

*includes building stone production (about 0.5 percent of total)

FIGURE 8.5

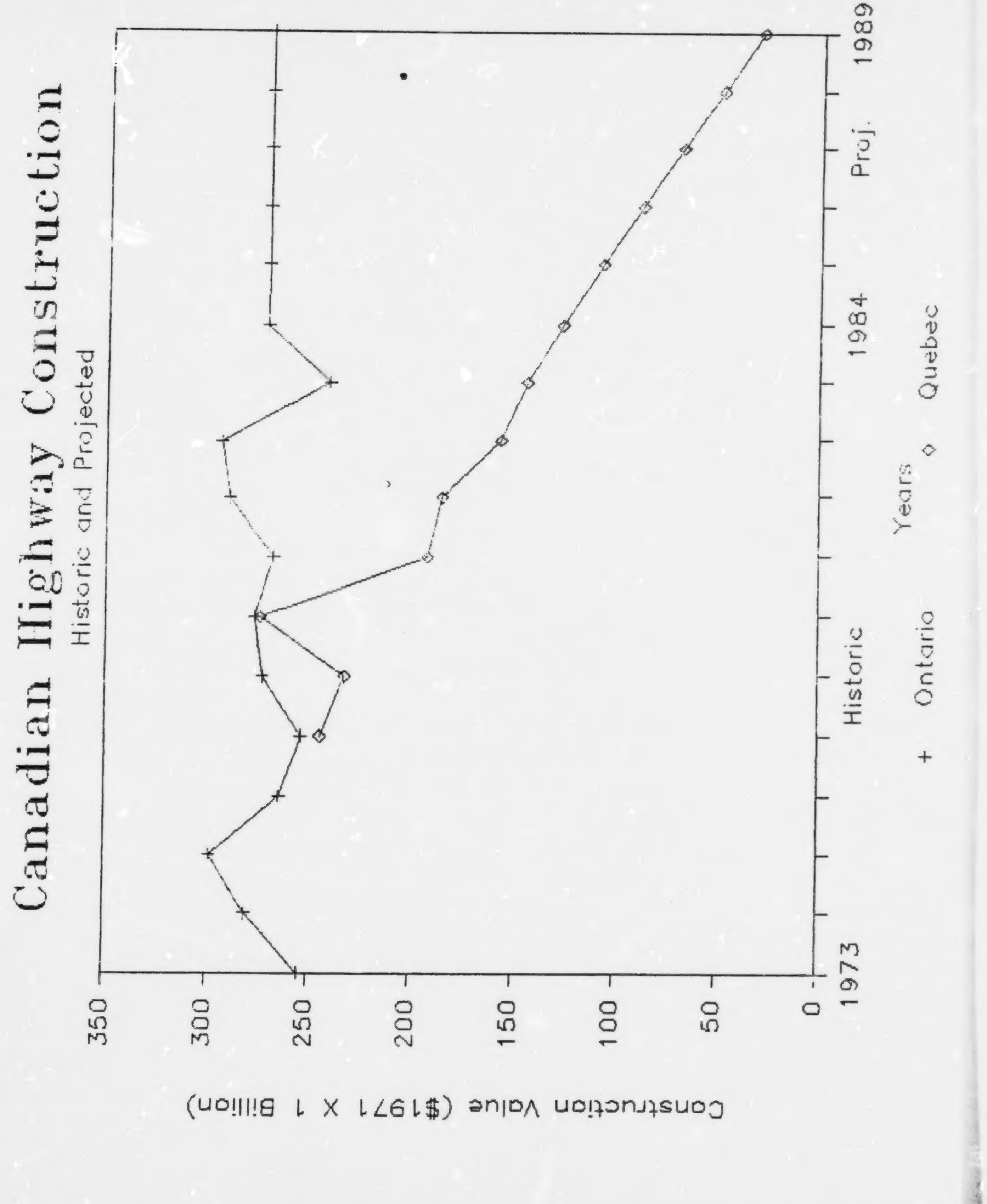
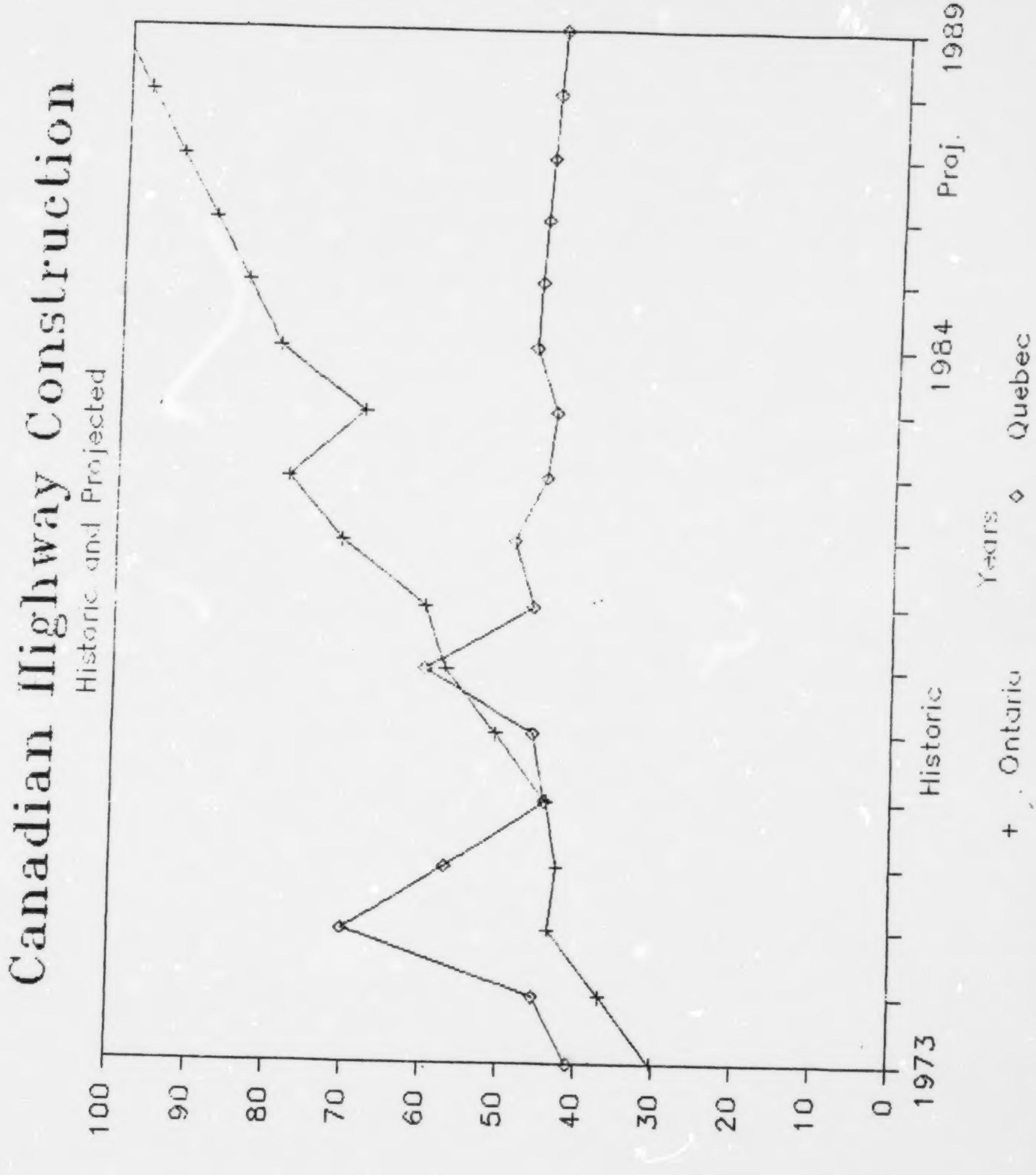

Canadian Highway Construction
Historic and Projected
Construction Value ($1971 X 1 Billion)
350
300
250
200
150
100
50
0
1973
Historic
1984
Proj.
1989
Years
+ Ontario
◇ Quebec

FIGURE 8.6


Canadian Highway Construction
Historic and Projected
Construction Value (X $10 Billion)
100
90
80
70
60
50
40
30
20
10
0
1973
1984
1989
Historic
Years
Proj.
+ Ontario
◇ Quebec

Ontario's major highway expenditures occurred in the 1960s, Quebec's in the 1970s, thus it is not surprising that Ontario's expenditures reached a stable level of expenditure during the 1973 to 1984 period. This level could be continued indefinitely reflecting a constant level of operation, maintenance and new construction.

In terms of Canadian aggregate classification, highway construction uses:

sand and gravel: concrete aggregate
    road bed, surface
    fill
    asphalt aggregate
    other special uses (such as asphalt filler)

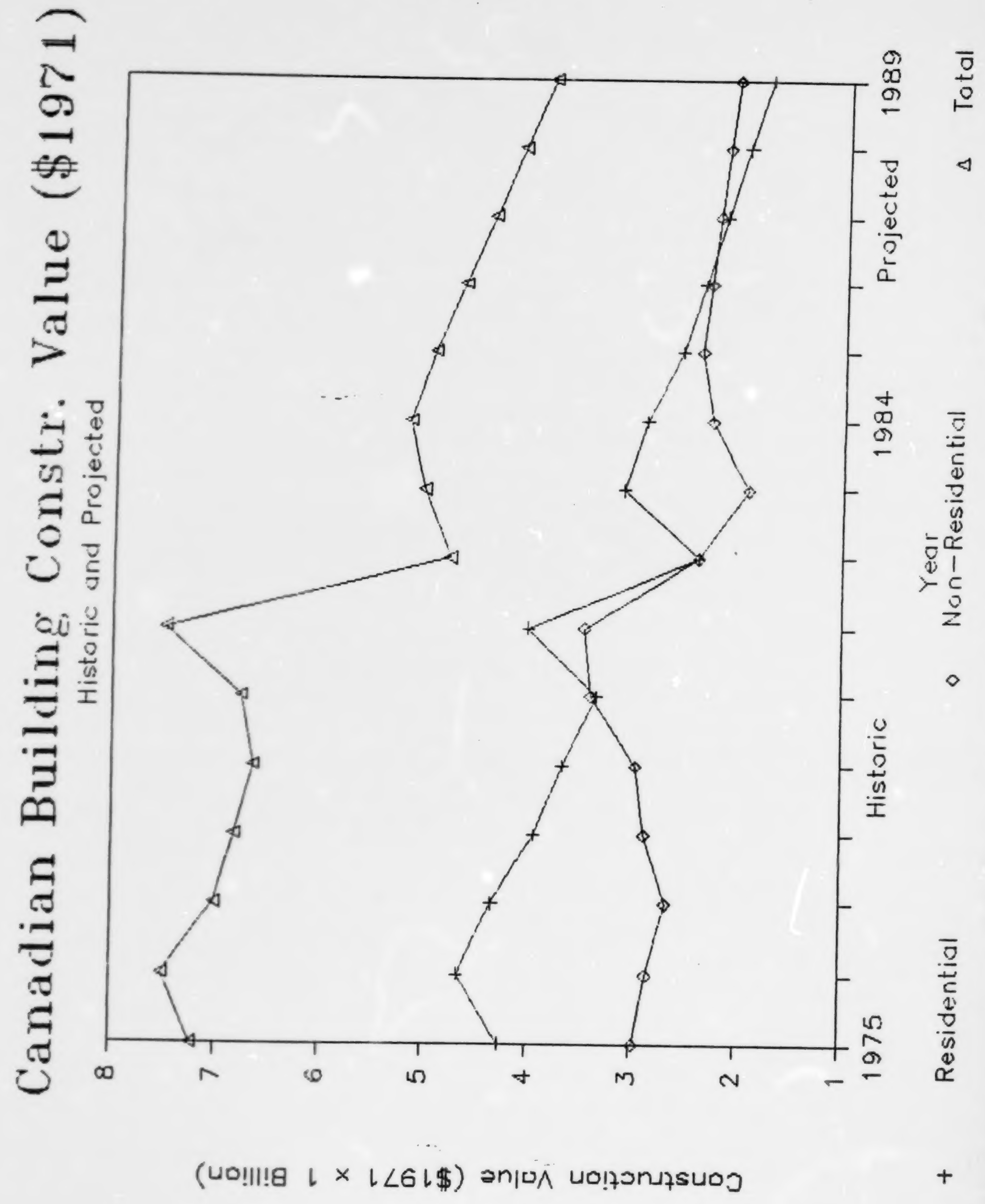
crushed stone: crushed
    - concrete aggregate
    - asphalt aggregate
    - road material
  pulverized
    - asphalt filler

8.3.1.4 Building Construction

In constant dollars, the value of building construction in Canada has decreased steadily since the mid-1970s with the only year of exception being 1981.

Residential construction, in particular, has declined substantially (33 percent from 1976 to 1984) (see Figure 8.7).

FIGURE 8.7


Canadian Building Constr. Value ($1971)
Historic and Projected
Construction Value ($1971 x 1 Billion)
8
7
6
5
4
3
2
1
1975
1984
1989
Historic
Projected
Year
+ Residential
◇ Non-Residential
Δ Total

On a province-by-province analysis, Ontario and Quebec have experienced less precipitous declines in building construction value (see Figures 8.8 and 8.9).

Projecting past trends into the short-term future (1989), Canadian building construction will continue to decline at 2.5 percent per annum. Using the same technique, Quebec's construction value will decline 1.5 percent per annum and Ontario, 1.6 percent per annum.

As for highway construction, it is doubtful whether real value declines in building construction can continue indefinitely. Basic levels of new construction and maintenance of existing infrastructure are required and these levels represent a base of construction activity below which activity cannot slip except for short time periods. What the base level is, in dollars, is not known.

Building construction uses the following aggregate types (Canadian designation):

sand and gravel: concrete aggregate
mortar sand
fill
other special uses

crushed stone: crushed
- concrete aggregate
- roofing granules
- stucco dash
- other uses

FIGURE 8.8

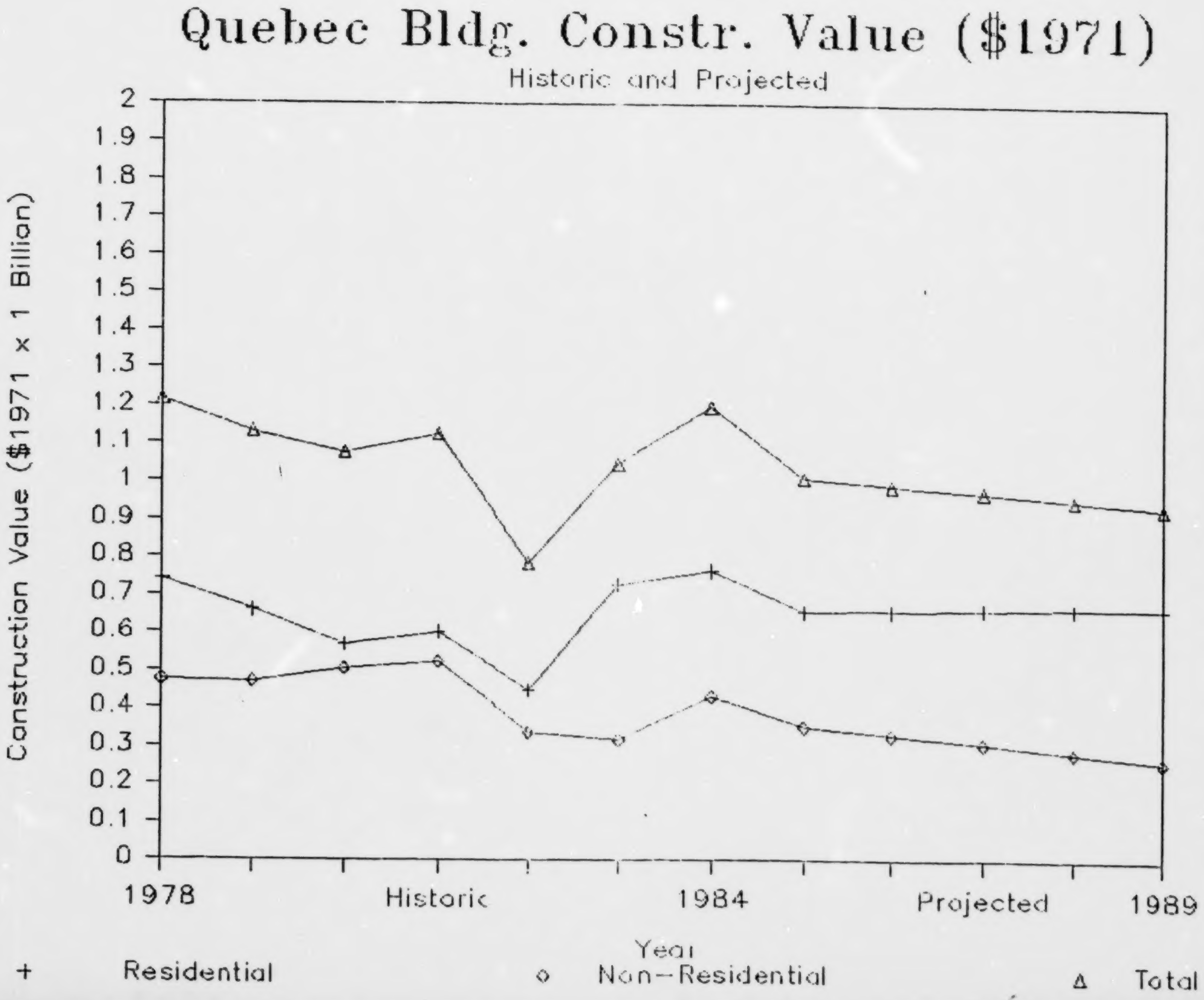
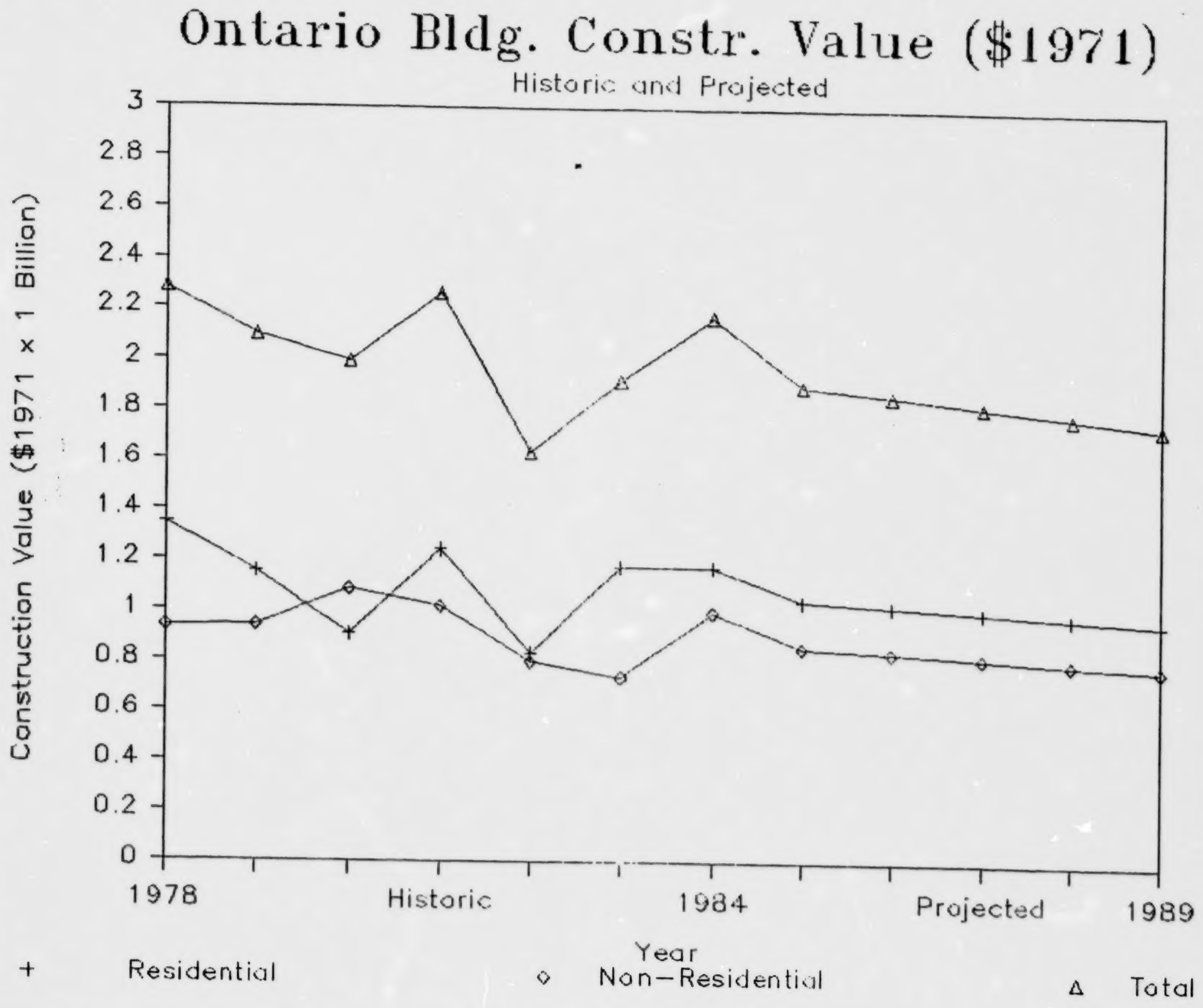

Quebec Bldg. Constr. Value ($1971)
Historic and Projected
Construction Value ($1971 x 1 Billion)
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1978
Historic
1984
Projected
1989
Year
+ Residential
◇ Non-Residential
Δ Total

FIGURE 8.9


Ontario Bldg. Constr. Value ($1971)
Historic and Projected
Construction Value ($1971 x 1 Billion)
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1978
Historic
1984
Projected
1989
Year
+ Residential
◇ Non-Residential
Δ Total

8.3.1.5 Real Personal Income

As mentioned earlier, income trends are relatively good indicators of construction activity. As seen in Figure 8.10, real personal income for Ontario and Quebec is forecast to grow slowly, but steadily at 1.5 percent. The significance of this trend is that it highlights the anomaly of declining building construction expenditures and reinforces the contention that building construction expenditures should stop decreasing and start increasing in the near future.

8.3.1.6 Evaluation

Previous studies have projected a growth in aggregate demand in Ontario between 0.4 percent and 1.4 percent per annum (see Figure 8.11)*. If this is indeed true, then Ontario's building construction industry will need to follow provincial personal income trends and highway expenditures following the existing trend. This will likely occur.

It is likely that Quebec's demand for aggregate will grow more slowly than that for Ontario due to the sinificant decrease in highway construction expenditures. As a province, Quebec has relied much more on construction "mega-projects" through the 1960s and 1970s (Expo '67, James Bay, Olympics) than Ontario, and if a new mega-project was started, its aggregate demand could exceed Ontario's demand.

FIGURE 8.10

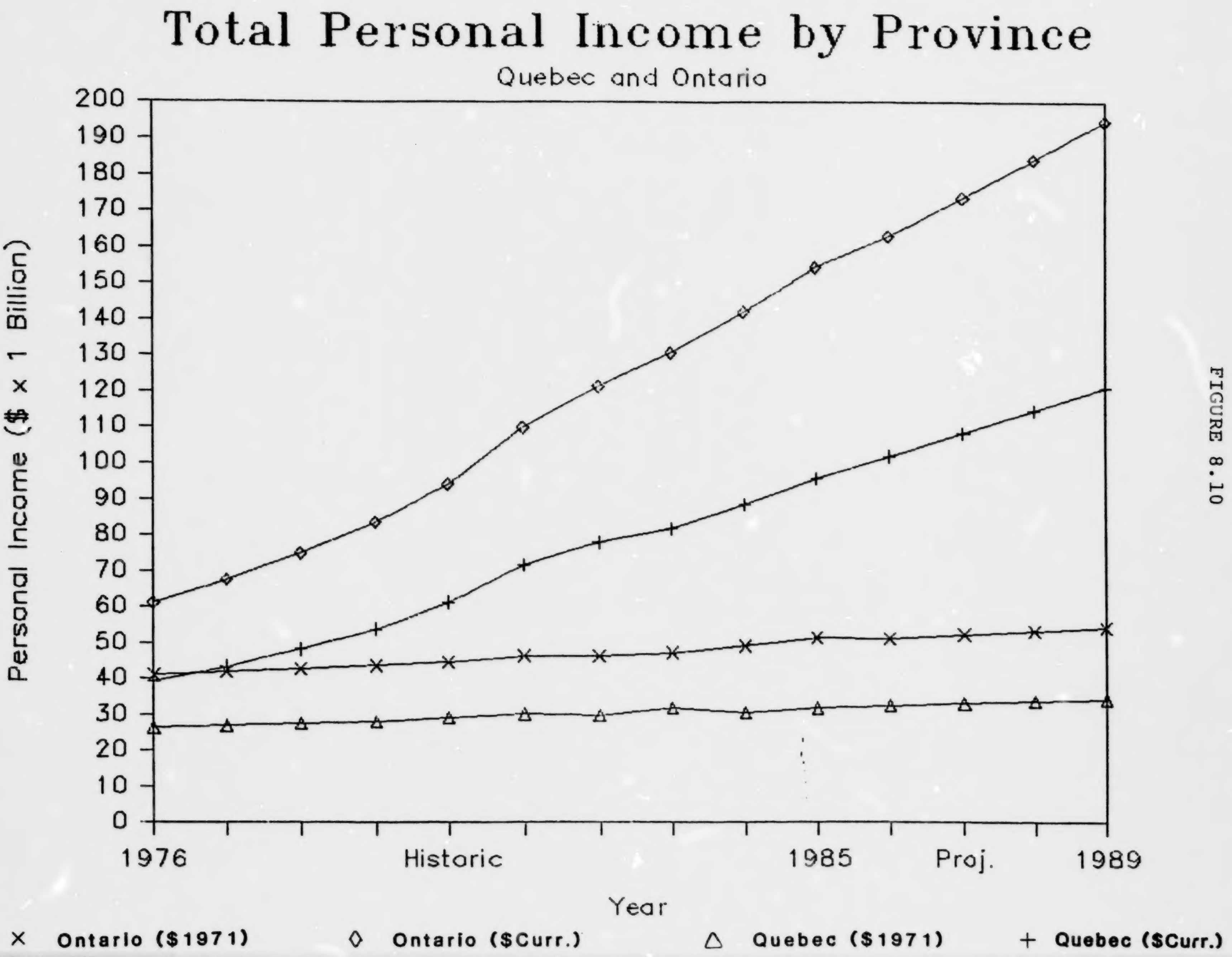
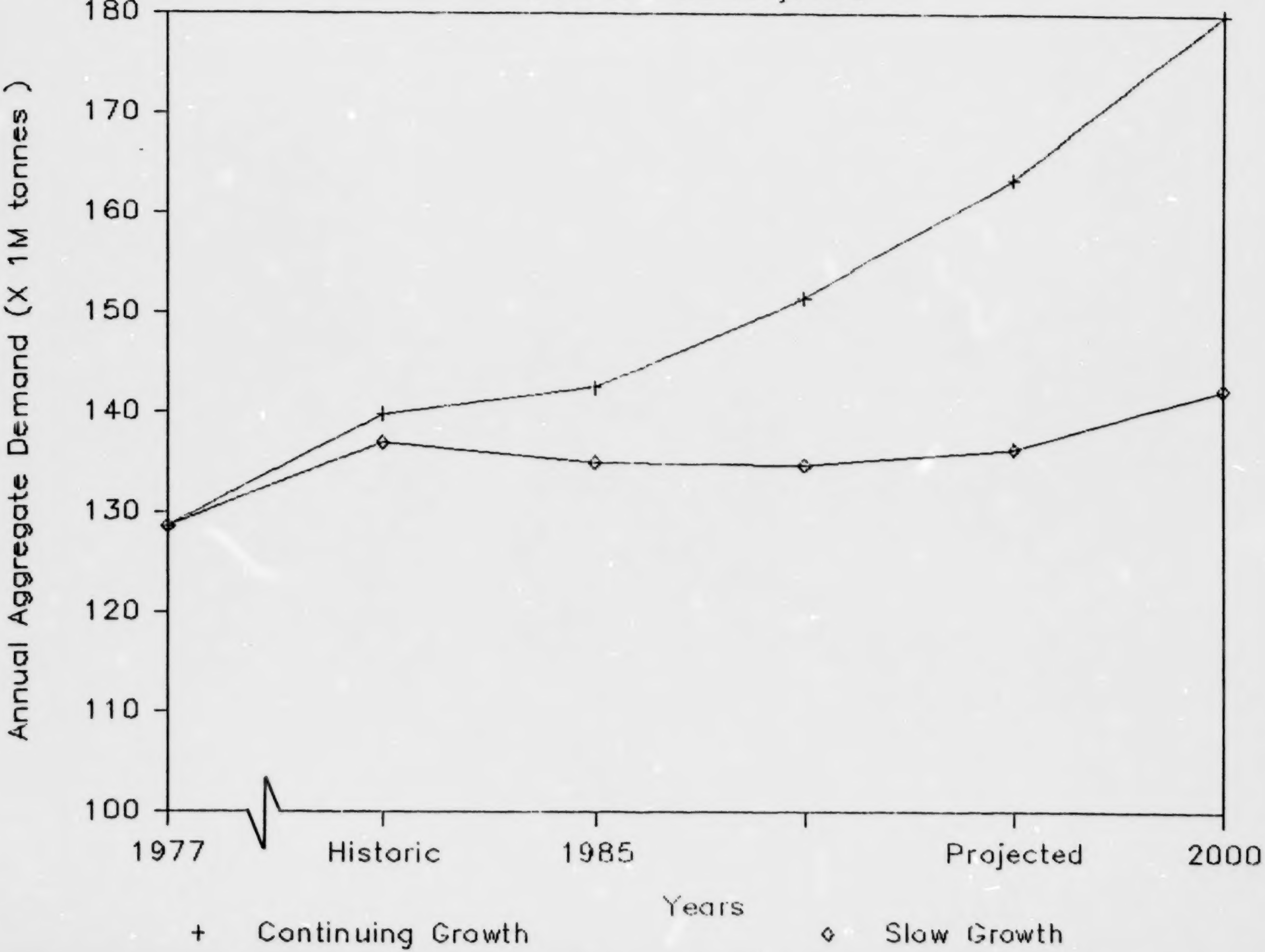

Total Personal Income by Province
Quebec and Ontario
Personal Income ($ x 1 Billion)
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1976
Historic
1985
Proj.
1989
Year
× Ontario ($1971)
◇ Ontario ($Curr.)
△ Quebec ($1971)
+ Quebec ($Curr.)

FIGURE 8.11



Ontario Aggregate Demand

Historic and Projected

8.3.2 Long-Term

As discussed earlier (Section 8.2.2) the long-term outlook for American aggregate demand is for a market very similar to the existing market. A growth rate of 1.5 percent per annum has been forecast for the United States until the year 2005, with many peaks and valleys of production predicted within that period.

For Canada the outlook is similar. One report has projected a growth rate in Ontario's aggregate demand of 0.4 percent to 1.4 percent per annum until the year 2000. For Quebec, the outlook should be similar, perhaps even higher as that province recovers from its highway and building construction slump of the 1970s. For both provinces a growth rate of 1.4 percent has been projected until the year 2000, yielding a production in that year of 74.90 k tonnes in Quebec and 109.6 k tonnes in Ontario.

9.0 TRENDS IN AGGREGATE PRICING

Based upon past performance (1977-1985) North American aggregate prices have followed the long-term trend of inflation (Table 9.1). However, as is typical of most raw materials (minerals, agricultural products, lumber) agregates have much more pronounced cycles of "boom and bust". For example, during the period 1977-1980 aggregate prices increased much faster than inflation with a differential of up to 11.6 percent. On the other hand, during the 1981-1985 period aggregate prices have slowed their rate of increase and, in 1983 and 1984, decreased. The differential has been as high as 9.4 percent.

Based upon this anlaysis, it is estimated that aggregate prices will follow the trend of inflation. However, the prices will be cyclical and could lead or lag inflation depending on the "boom or bust" cycle.

TABLE 9.1

COMPARISON OF CONSUMER PRICE INDEX AND PRICE CHANGES FOR CRUSHED STONE IN THE UNITED STATES (1977-1985)

Source: Engineering News-Record - 20 cities average)

Date	Annual Change in Consumer Price Index, % Jan. to Jan.	Crushed Stone		
		Price	% Change Six Months	Annual Rate Jan. to Jan.
1977 January		$4.39		
			3.6	
July	6.5	4.47		9.3
			14.8	
1978 January		4.80		
			10.0	
July	7.6	5.04		19.2
			27.0	
1979 January		5.72		
			16.1	
July	11.2	6.18		10.1
			4.0	
1980 January		6.30		
			14.6	
July	13.5	6.76		18.9
			21.6	
1981 January		7.49		
			0.3	
July	10.4	7.50		2.7
			5.1	
1982 January		7.69		
			1.6	
July	6.1	7.75		2.5
			3.3	
1983 January		7.88		
			0.5	
July	3.2	7.90		-0.1
			-0.8	
1984 January		7.87		
			-4.8	
July	4.3	7.68		-5.1
			-4.9	
1985 January		7.47		
			4.8	
July	3.6	7.65		

APPENDIX A

DESCRIPTIONS OF AGGREGATE MARKETS IN THE UNITED STATES AND CANADA

MAINE

SAND AND GRAVEL

Production:

Maine's sand and gravel production declined during the 1979 to 1984 period. Peak production occurred in 1979 with 11.0M short tons, worth $20.5M. The lowest year was 1983 with a production of 4.8M short tons, worth $12.1M. In 1984, production was estimated at 6.4M short tons at $15.4M, representing 45% of Maine's nonfuel mineral production.

Sand and gravel is produced in every county with the three leading counties being Cumberland, Penobscot and York.

The four principal producers in the state are:

Cianbro Corporation of Pittsfield;
Harry C. Crooker & Sons Inc. of Brunswick;
Genert Concrete Works Inc. of Sanford; and
Maine Development of Transportation of Augusta.

Value:

Sand and gravel produced in 1984 was valued an average of $2.41 per short ton. Since 1979, the unit value has increased 30% but has increased little during the 1980's. (See Figure 1)

There is significant variation in the value of sand and gravel depending on end use. As shown in Table 1, the highest value products are railroad ballast and concrete aggregrate.

Consumption:

The major uses of the sand and gravel produced in Maine are road base and coverings, asphaltic concrete, fill, and concrete aggregrate. (See Table 2).

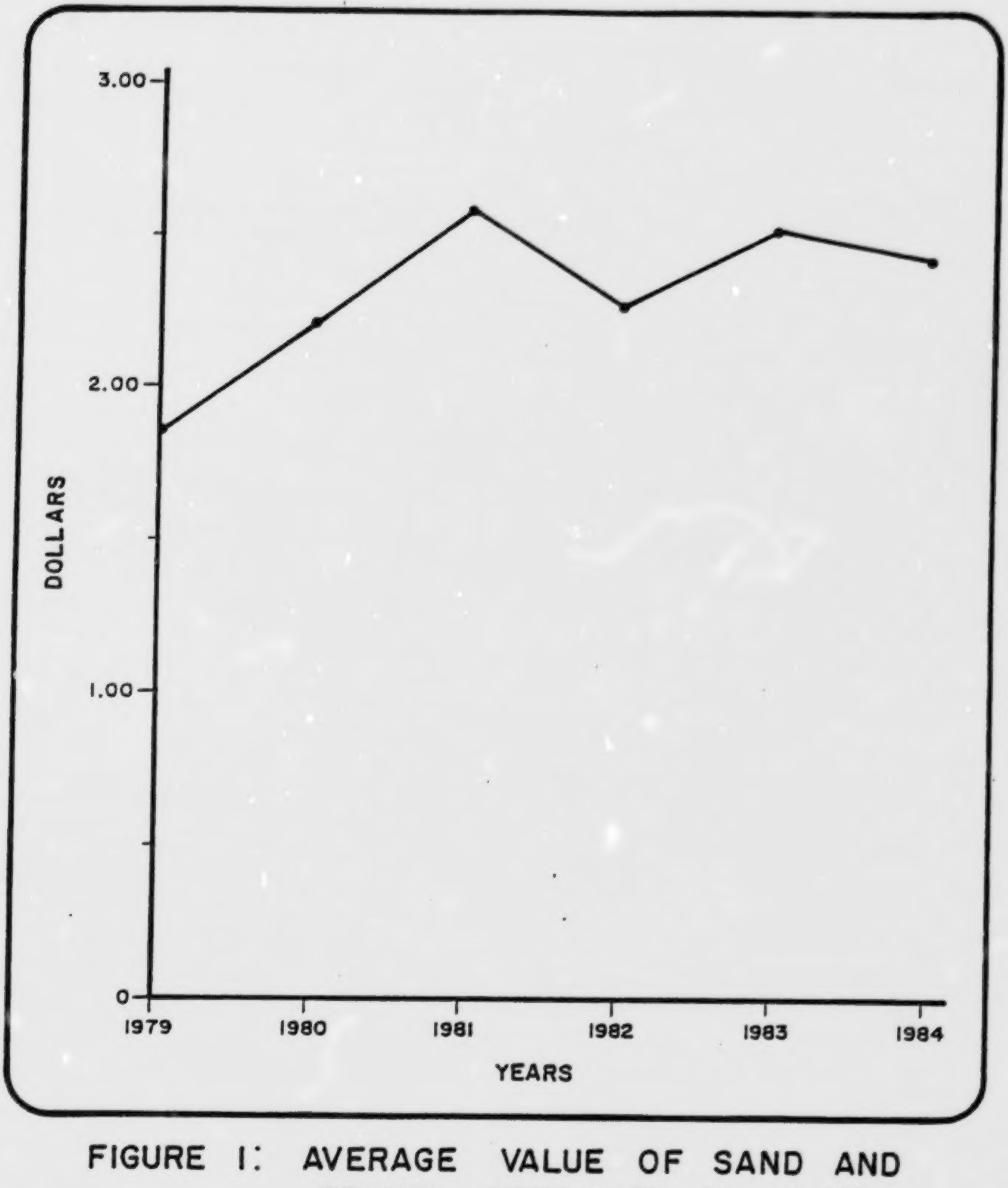


FIGURE 1: AVERAGE VALUE OF SAND AND GRAVEL PRODUCED IN MAINE, 1979 – 1984

(U.S. Bureau of Mines Minerals Yearbook)

TABLE 1

UNIT VALUE OF SAND AND GRAVEL PRODUCTS FOR END USES, MAINE, 1982

("1982, U.S. Bureau of Mines and Minerals Yearbook")

Use	Value Per Short Ton
Railroad Ballast	$4.27
Concrete Aggregrate	$3.09
Concrete Products	$2.91
Other	$2.70
Asphaltic Concrete	$2.69
Fill	$1.93
Road Base & Coverings	$1.82
Snow & Ice Control	$1.33
Average	$2.26

TABLE 2
USES OF SAND AND GRAVEL PRODUCED IN MAINE, 1982

("1982 U.S. Bureau of Mines and Minerals Yearbook")

Use	Quantity M Short tons	Percent
Road Base and Coverings	1.83	27.3
Asphaltic Concrete	1.69	25.2
Fill	1.02	15.2
Concrete aggregate	1.01	15.1
Snow and ice control	0.73	10.9
Other	0.30	4.5
Concrete products	0.10	2.5
Railroad ballast	0.02	0.3
Total	6.70	100.0

CRUSHED ROCK

Production:

Production has declined steadily during the 1979-1984 period. In 1979 it was 2.1M short tons while in 1984 it was 0.9M short tons. The 1984 production was worth \$3.04M or about 9% of Maine's non-fuel mineral production.

Maine's crushed rock production is very dependent upon the activity of the cement plant in Thomaston, New England's only cement plant and a large consumer of crushed limestone.

In 1983, crushed stone came from four counties (see Table 3). Principal producers were:

Blue Rock Industries in Westbrook;
Lane Construction Corporation in Presque Isle;
Lime Products Corporation in Union; and
The Cook Concrete Company, Portland.

Value:

The average unit value of crushed rock produced in 1984 was \$3.33 per short ton. The unit value has decreased steadily (8%) since 1979 when it was \$3.62 per short ton. The decline is even more pronounced when the values are adjusted for inflation: assuming five percent average annual inflation, producers received only 72% of 1979 value for their stone in 1984.

Consumption:

Main uses for Maine crushed stone are cement and construction.

MARKET INTELLIGENCE

Portland is one of New England's top growth centres with much construction and renovation work.

TABLE 3
SOURCES OF CRUSHED ROCK IN MAINE, 1983

COUNTY	STONE TYPE	QUARRIES
Aroostock	limestone	1
	marl	1
Cumberland	sandstone	2
	traprock	1
Kennebec	limestone	1
Knox	limestone	3

NEW HAMPSHIRE
SAND AND GRAVEL

Production:

New Hampshire's production of sand and gravel has declined since the late 1970's. Production fell from 7.1M short tons in 1979 to 4.6M short tons in 1984, reaching a low of 4.0M short tons in 1983. The value of production has fallen as well, from $15.8M in 1979 to $14.1M in 1984 with a low value of $12.1M in 1983. The production in 1984 represented 67% of the state's nonfuel mineral production.

Every county in the state produces sand and gravel. Table 1 presents the volume of material produced in each county. The counties are listed in order of volume of production.

The four largest producers in 1983 were:
Granite State Concrete Company Inc. of Milford;
Manchester Sand and Gravel of Hooksett;
Osspippee Aggregate Corp of Ossippee; and
F.W. Whitcomb Construction Corp. of Bellows Falls.

Value:

Sand and gravel produced in 1984, was worth an average of $3.06 per short ton. That price represents an increase of 42% since 1979, however, there has been little increase during the 1980's

The unit value of sand and gravel depends upon end use (see Table 2). The highest value products are concrete aggregate and asphaltic concrete.

Consumption:

In terms of volume, the leading uses of sand and gravel in 1982, were concrete aggregate, road base and coverings, and asphaltic concrete (see Table 3).

TABLE 1
VOLUME OF SAND AND GRAVEL
PRODUCED IN NEW HAMPSHIRE BY COUNTY, 1982
("1983, U.S. Bureau of Mines and Minerals Yearbook")

County	Quantity M Short Tons	Percent
Carroll	0.96	22.1
Merrimack	0.90	20.7
Hillsborough	0.79	18.1
Grafton	0.28	6.5
Coos	0.28	6.3
Rockingham	0.27	6.3
Sullivan	0.24	5.6
Belknap	0.62	14.2
Cheshire	0.62	14.2
Strafford	0.62	14.2
Total	4.33*	100.0**

---

* Total does not equal 4.33 due to rounding.

** Total does not equal 100.0 due to rounding.

TABLE 2

UNIT VALUE OF SAND AND GRAVEL PRODUCTS FOR END USES, NEW HAMPSHIRE, 1982

("1982, U.S. Bureau of Mines and Minerals Yearbook")

Use	Value, per Short Ton
Concrete aggregate	$3.29
Asphaltic concrete	3.16
Concrete products	3.09
Plaster and gunite sands	3.03
Road base and coverings	2.80
Other	2.73
Railroad ballast	2.23
Fill	1.89
Snow and ice control	1.61
Average	$2.91

TABLE 3
USES OF SAND AND GRAVEL PRODUCED IN NEW HAMPSHIRE, 1982

("1982, U.S. Bureau of Mines and Minerals Yearbook")

Use	Quantity M Short Tons	Percent
Concrete aggregate	1.42	32.8
Road base and coverings	1.11	25.6
Asphaltic concrete	0.90	20.8
Fill	0.33	7.6
Snow and ice control	0.24	5.5
Other	0.18	4.2
Concrete products	0.12	2.8
Plaster and gunite sand	0.03	0.7
Railroad ballast	0.01	0.2
TOTAL	4.33	100.0**

---

* Total does not equal 4.33 due to rounding.

** Total does not equal 100% due to rounding

CRUSHED ROCK

Production:

Production has flucuated between 0.6 and 1.0M short tons through the 1980's. In 1984, it was 0.85M short tons worth $2.7M or about 13% of New Hampshire's nonfuel mineral production.

In 1981, crushed stone came from four counties: Cheshire, Grafton, Merrimack, and Rockingham. All this material was traprock except for a small volume of granite from Grafton. Leading producers were:

Boston Sand and Gravel/Cook Concrete Company of Hooksett;
Iafolla Industries Inc. of Portsmouth; and
Lebanon Crushed Stone Inc. of West Lebanon.

Value:

The average unit value of crushed rock produced in 1984 was $3.18 per short ton. The value is low in comparison to 1981 and 1982 when it was $3.91 and $5.17 respectively. It is higher than the 1983 value when it was $3.02

Consumption:

The main uses for crushed rock are for concrete and asphalt aggregrate (see Table 4).

TABLE 4
USES FOR CRUSHED ROCK
PRODUCED IN NEW HAMPSHIRE, 1983
("1983 U.S. Bureau of Mines and Minerals Yearbook")

Use	Quantity M Short Tons	Percent
Coarse aggregate (greater than 1.5 inch)		
- riprap and jetty stone	0.008	0.8
- filter stone	0.003	0.3
Coarse and fine aggregate		
- graded road base or subbase	0.035	3.7
- crusher or fill or waste	0.005	0.5
Other (including concrete aggregate, coarse and stone sand, and bituminous aggregate)	0.896	94.7
Total	0.946*	100.0

---

* Total does not equal 0.946 due to rounding.

MASSACHUSETTS
SAND AND GRAVEL

Production:

Massachusetts has traditionally lead New England in the production of sand and gravel and crushed rock. However, the market has not been strong in recent years.

Production of sand and gravel declined steadily from 16.7M short tons in 1979 to 10.4M short tons in 1983. However, it did increase to 12.9M short tons in 1979. The value of 1984 production was $41.2M and represented 41% of the state's nonfuel mineral production

While every county produces sand and gravel, several produce only small amounts and seemingly on an intermittant base (Dukes, Nantucket, and Hampshire). Leading producing counties are Middlesex, Worcester, and Norfolk.

These are several large producers in the state including:
S.M. Lorusso & Sons Inc. of Walpole;
Nemasket Construction Co. Inc. of Middleboro;
San-Vel Concrete Corp of Littleton; and
Worcester Sand and Gravel Co. Inc. of Shrewsbury.

Value:

In 1984, sand and gravel had an average unit value of $3.19 per short ton. That price represented an increase of 28% over the 1981 value ($2.50) but a decrease of 8% from the 1983 value ($3.48).

The unit value of sand and gravel depends upon end use (see Table 1). For Massachusetts, the highest valued end uses were plaster and gunite sands, concrete aggregate, and asphaltic concrete.

TABLE 1

UNIT VALUE OF SAND AND GRAVEL PRODUCTS FOR END USES, MASSACHUSETTS, 1982

Use	Value per Short Ton
Plaster and gunite sands	$4.10
Concrete aggregate	$3.50
Asphaltic concrete	$3.19
Other	$3.10
Concrete products	$2.70
Road base and coverings	$2.39
Snow and ice control	$2.20
Fill	$1.75
Railroad Ballast	$1.50
Average	$2.87

Consumption:

As shown in Table 2, the leading uses of sand and gravel in 1982 were concrete aggregate, road base and coverings, and fill.

TABLE 2
USES OF SAND AND GRAVEL
PRODUCED IN MASSACHUSETTS 1982
("1982 U.S. Bureau of Mines and Minerals Yearbook")

Use	Quantity	
	M Short Tons	Percent
Concrete aggregrate	5.05	42.1
Road base and coverings	2.09	17.4
Fill	1.80	15.0
Asphaltic concrete	1.03	8.6
Concrete products	0.78	6.5
Snow and ice control	0.73	6.1
Other (includes both catagories below)	0.53	4.4
Plaster and gunite sands	W	-
Railroad ballast	W	-
Total	12.00**	100.0**

---

* Totals do not equal 12.00 due to rounding.

** Totals do not equal 100.0 due to rounding.

CRUSHED ROCK

Production:

In contrast to sand and gravel, crushed rock production grew in the 1980's (four of five years). Production was 7.3M short tons in 1980 and 8.5M short tons in 1984 - an increase of 16%. The 1984 production was valued at $39.0M and represented 39% of the states nonfuel mineral production.

Crushed stone was produced in eleven of the state's fourteen counties. Only Barnstable, Dukes and Nantucket counties produced no stone.

Traprock represented 77% of 1983 production and was produced in nine counties (twenty quarries). Crushed granite was produced in Bristol and Norfolk counties (four quarries) and limestone in Berkshire county (four quarries).

Leading producers were:
Pfizer Inc. of Adams;
Lee Lime Corp of Lee;
Tilcon-Warren Quarries Inc of Acushnet;
Lynn Sand and Stone Co. of Swampscott and Lane; and
John S. Lane and Son Inc. of Westfield.

Value:

The average unit value of crushed rock in 1984 was $4.59 per short ton. This was the third straight year the unit price declined from its 1981 value of $5.18.

There is a greater variation in value depending on end use (see Table 3) with special uses such as agricultural limestone, chemical and metallurgical flux stone, poultry grit and asphalt fillers representing high valued end uses.

TABLE 3
UNIT VALUE OF CRUSHED STONE
PRODUCTS FOR END USES, MASSACHUSETTS, 1983

Use	Value per Short Ton
Coarse aggregrate (over 1.5 inch):	
- Riprap and jetty stone	$ 3.86
- filter stone	$ 4.43
Coarse aggregrate, graded:	
- concrete aggregate, coarse	$ 3.24
- bituminous aggregrate, coarse	$ 4.84
- railroad ballast	$ 3.57
Fine aggregrate (under 0.375 inch):	
- stone sand, bituminous mix or seal	$ 4.29
- graded road base or subbase	$ 4.20
- unpaved road surfacing	$ 3.73
- crusher run or fill or waste	$ 5.08
Agricultural limestone	$15.89
Chemical and metallurgical fluxstone	$15.50
Other (including poultry grit and mineral food, stone sand, etc.)	$ 5.44
Average	$ 4.65

Consumption:

The most common uses for crushed rock in 1983, were for coarse bituminous aggregate, special uses, and unpaved road surfacing (see Table 4). Use depended upon rock source: traprock was used mainly for bituminous aggregrate and unpaved road surfaces, granite was used for bituminous aggregrate and dense-graded road base, and limestone was used for lime, agricultural limestone, poultry grit and filler.

TABLE 4
USES FOR CRUSHED ROCK PRODUCED IN MASSACHUSETTS, 1983
("1983, U.S. Bureau of Mines and Minerals Yearbook")

	Quantity	
Use	M Short Tons	Percent
Coarse aggregate (over 1.5 inch)		
- riprap and jetty stone	0.51	6.6
- filter stone	0.15	2.0
Coarse aggregrate, grades		
- concrete aggregate, coarse	0.32	4.1
- bituminous aggregate, coarse	1.83	23.6
- railroad ballast	0.79	10.1
Fine aggregate (under 0.375 inch)		
- stone sand, bituminous mix or seal	0.54	7.0
- graded road base or subbase	0.56	7.3
- unpaved road surfacing	0.91	11.7
- crusher run or filler waste	0.21	2.7
Agricultural limestone	0.10	1.3
Chemical and metallurgical flux stone	-	-
Other (including poultry grit and mineral food stone sand, etc.)	1.83	23.6
Total	7.74*	100.0

---

* Total does not equal 7.74 due to rounding.

RHODE ISLAND
SAND AND GRAVEL

Production:

Sand and gravel has undergone a significant decline in Rhode Island over the last ten years. In 1975, production was 2.9M short tons; in 1979, it was 3.5M short tons; and in 1984, it was 1.2M short tons. In the period 1975 to 1980, production averaged 3.0M short tons, in the 1981 to 1984 period, it averaged 1.3M short tons, a decline of 57%.

Sand and gravel and crushed stone represent almost 100% of the states nonfuel mineral activity. In 1983, sand and gravel production (1.0M short tons) was valued at $2.4M or 30% of the state's mining value.

Each of the state's five counties produced sand and gravel in 1982. The leading county was Washington followed by Providence.

Large sand and gravel produces include:
A. Cardi Construction Co. Inc. of Coventry;
J.H. Lynch & Sons Inc. of Ashton;
River Sand and Gravel Co. of Pawtucket;
J. Santoro of Providence; and
Taggart Sand Prod. Corp. of Lincoln.
The number of producers declined from twenty-two in 1980 to fifteen in 1983.

Value:

While production has decreased over the last ten years, the average unit value has increased (see Figure 1). There is a substantial variation in unit value amongst end uses for sand and gravel, as seen in Table 1. The highest value uses in 1982 were plaster and gunite sands and concrete products.

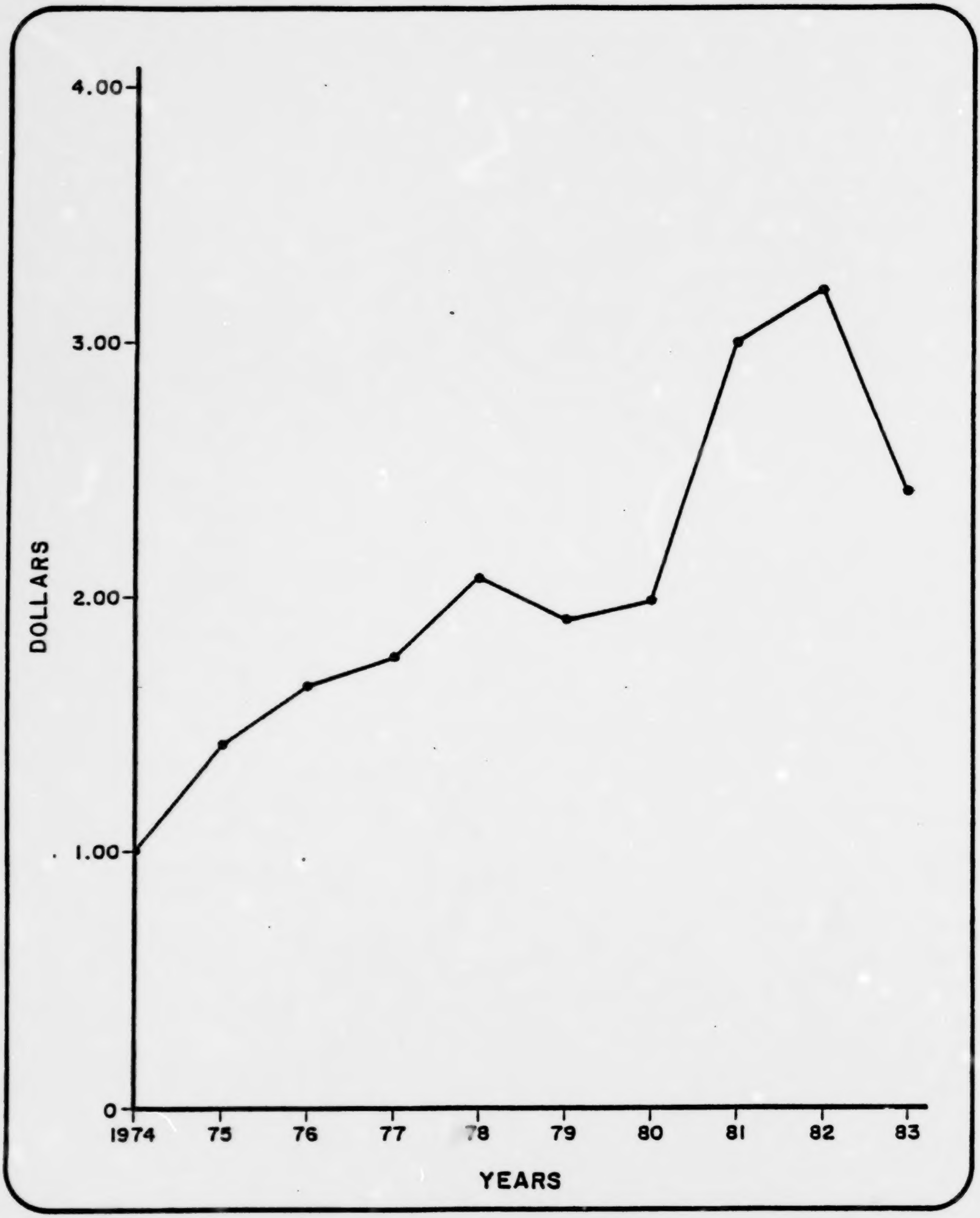


FIGURE 1: VALUE OF SAND AND GRAVEL PRODUCED IN RHODE ISLAND, 1974 – 1983

TABLE 1
UNIT VALUE OF SAND AND GRAVEL PRODUCTS FOR MAJOR END, RHODE ISLAND, 1982
("1982, U.S. Bureau of Mines and Minerals Yearbook")

Use	Value per Short Ton
Plaster and gunite sands	$4.59
Concrete products	$4.50
Other	$3.96
Snow and ice control	$3.64
Road base & coverings	$3.01
Concrete aggregate	$2.90
Asphaltic concrete	$2.56
Fill	$2.20
Average	$3.20

Consumption:

Two of the main uses of sand and gravel in Rhode Island are road base and coverings and fill (see Table 2).

TABLE 2
USES OF SAND AND GRAVEL PRODUCED IN RHODE ISLAND, 1982
("1982, U.S. Bureau of Mines and Minerals Yearbook")

Use	Quantity	
	M Short Tons	Percent
Fill	0.28	24.2
Road base and coverings	0.23	20.0
Asphaltic concrete	0.12	10.0
Concrete aggregate	-	-
Plaster and gunite sands	-	-
Concrete products	0.53	45.8
Snow and ice control	-	-
Other	-	-
Total	1.15*	100

---

* Total does not equal 1.15 due to rounding.

CRUSHED ROCK

Production:

After suffering a steady decline from 1978 to 1982, crushed rock production jumped dramatically in 1983, going to 0.97M short tons from 0.13M short tons the previous year. The production was worth $5.5, about 69% of Rhode Island's non-fuel mineral production. In 1984, production was estimated at 0.95M short tons. Expansion in crushed stone production helped to offset large declines in sand and gravel.

The state's production comes from Newport and Providence Counties.
Principal producers are:
Forte Brothers Inc. of Cumberland;
Conklin Limestone Co. Inc. of Lincoln; and
Tilcon Inc. of Cranston.

Value:

The average unit value of crushed stone was $5.67 per short ton in 1983. No information was available for specific uses.

Consumption:

The main use for crushed stone was for "other" uses (Table 3) a catagory which included agricultural limestone, unpaved road surfacing, whiting or whiting substitute, roofing granules, among others.

TABLE 3
USES FOR CRUSHED ROCK
PRODUCED IN RHODE ISLAND, 1983

Use	Quantity	
	M Short Tons	Percent
Coarse aggregrate (over 1.5 inch)		
- raprap and jetty stone	0.004	0.4
- filter stone	0.089	9.2
Coarse aggregate, graded		
- concrete aggregate, coarse	0.027	2.8
- bituminous aggregate, coarse	0.082	8.4
- railroad ballast	0.047	4.8
Fine aggregate (under 0.375 inch)		
- stone sand, concrete	0.014	1.4
- stone sand, bituminous mix or seal	0.055	5.7
Other (including agriculture limestone, unpaved road surfacing, etc.)	0.652	67.1
Total	0.971	100.0*

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* Total may not equal 100.0% due to rounding.

CONNECTICUT
SAND AND GRAVEL

Production:

Connecticut's production of sand and gravel slumped during the early 1980's. From a 1979 value of 10.0M short tons, production fell to 4.9M short tons in 1982, a decrease of 51%. It has since increased to 5.5M short tons (1984).

The value of 1984 production was $19.0M, representing 25% of the state's nonfuel mineral production.

Every county in the state produces sand and gravel. The leading counties are Hartford, New Haven, and Tolland.

Leading producers were:
Dan Beard Inc of Shelton and Derby;
Connecticut Sand and Stone Corp of Farmington and Canaan;
Elm City Construction Co. of North Haven;
F&F Concrete Corp of Plantsville; and
Dunning Sand and Gravel Co. of Farmington.

Value:

In 1984, sand and gravel produced in Connecticut was worth $3.45 per short ton. That price represented an increase of 46% over the 1981 price of $2.37 per short ton. The variation of price among end uses in 1982 is illustrated in Table 1.

Consumption:

By volume, the leading uses for sand and gravel were concrete aggregate, road base and coverings and fill in 1982 (see Table 2)

TABLE 1
UNIT VALUE OF SAND AND GRAVEL PRODUCTS FOR END USES, IN CONNECTICUT, 1982
(1982, U.S. Bureau of Mines and Minerals Yearbook")

Use	Unit Value per Short Ton
Plaster and gunite sands	$5.57
Other (including agricultural lime)	$4.36
Concrete aggregrate	$3.85
Asphaltic concrete	$3.69
Concrete products	$3.56
Snow and ice control	$3.15
Road base and coverings	$2.70
Fill	$2.35
Average	$3.33

TABLE 2
USES OF SAND AND GRAVEL IN CONNECTICUT, 1982
("1982, U.S. Bureau of Mines and Minerals Yearbook")

Use	Quantity	
	M Short Tons	Percent
Concrete aggregate	1.68	34.1
Road base and coverings	1.19	24.2
Fill	0.63	12.8
Asphaltic concrete	0.61	12.5
Snow and ice control	0.31	6.3
Other (including agricultural lime)	0.25	5.0
Concrete products	0.24	4.8
Plaster and granite sands	0.01	0.3
Total	4.92	100.0

CRUSHED ROCK

Production:

Connecticut's production of crushed rock did not suffer as large a decrease as sand and gravel during the early 1980's. In 1979, production was 8.3M short tons, in 1982 - the year of lowest production - it was 6.1M short tons - a decrease of 27%. In 1984, it was 7.7M short tons. It appears that crushed rock is replacing sand and gravel in the state.

There was production in four counties in 1983. Details of production are presented in Table 3. There were sixteen quarries in the state, thirteen for traprock and three for limestone. Connecticut supplied 10% of the traprock produced in the United States, ranking fifth among states.

Leading producers were:
Tilcon Inc. (the top producer of traprock in the United States) of Wauregan, North Banford, Southington, Plainville, and Farmington;
Edward Balf of Newington; and
York Hill Trap Rock Quarry Co. of Meriden.

Value:

In 1984, the average unit value of crushed rock produced in the state was $5.97 per short ton. Value varied with end use with "other" uses valued at $6.18 per short ton, coarse concrete aggregate valued at $4.33 per short ton, and coarse bituminous aggregate valued at $4.27. "Other" uses included macadam, graded road base or subbase, bituminous surface treatment aggregate, cement manufacture, lime manufacture, etc.

Consumption:

The main uses for crushed rock in the state are "other" (as defined above), coarse concrete aggregrate, and coarse bituminous aggregrate (see Table 4).

Market Intelligence:

The Connecticut Department of Environmental Protection in 1983 was given the authority to issue permits and levy user fees to sand and gravel dredging operations, developers of dams and reservoirs, and builders which alter coastal areas.

A boost to aggregrate producers across the U.S. is the four-year programme initiated by the Federal Surface Transportation Assistance Act. Of $57B authorized for the whole country, $48M will go to Connecticut.

TABLE 3
CRUSHED ROCK PRODUCTION BY COUNTY IN CONNECTICUT, 1983

(1983, U.S. Bureau of Mines and Minerals Yearbook")

County	Rock Type	Quantity M Short Tons
New Haven	Traprock	4.8
Hartford	Traprock	-
Windham	Traprock	-
Litchfield	Traprock	-
	Limestone	0.3

TABLE 4
USES FOR CRUSHED ROCK PRODUCED IN CONNECTICUT, 1983
("1983, U.S. Bureau of Mines and Minerals Yearbook")

Use	Quantity	
	M Short Tons	Percent
Coarse aggregate, graded:		
- concrete aggregate, coarse	0.35	4.5
- bituminous aggregate, coarse	0.47	6.1
Coarse and fine aggregrate, terrazzo and exposed aggregrate	-	-
Agricultural limestone	0.03	0.3
Chemical and metallurgical flux stone	-	-
Other	6.85	89.1
Total	7.70	100.0

NEW YORK
SAND AND GRAVEL

Production:

New York is one of the largest producers of sand and gravel in the United States. In 1983, it ranked as the eighth state in the value of its sand and gravel ($54.2M) and tenth in the volume (18.7M short tons). During the 1980's its production has remained static - within 5% of 18.0M short tons per year.

In 1983, production occurred in 56 of New York's 62 counties. Only the New York City counties of Bronx, Hamilton, New York, Queens, and Richmond were without sand and gravel operations. Leading production counties were: Cattaraugus, Suffolk, Dutchess, Rensselaer, and Erie.

Principal producers in 1983 were:

Koppers Co. Inc.;
Valente Gravel Inc. of Troy;
Roanoke Marbro Sand and Gravel Corp of Miller Place;
Buffalo Slag of Alfred and Franklinville; and
Concrete Materials Inc. of Homer, and Morrisonville.

Value:

In 1984, construction sand and gravel had an average value of $2.86 per short ton. That value represented an increase of 15% over the 1981 value of $2.49 but a decrease for the 1983 value of $2.90.

Table 1 presents the variation in unit values among the various end uses for sand and gravel in 1982. The highest values were plaster and gunite sands, concrete aggregate and asphaltic concrete.

TABLE 1

UNIT VALUE OF SAND AND GRAVEL PRODUCTS FOR END USES, NEW YORK, 1982

(1982, U.S. Bureau of Mines and Minerals Yearbook")

Use	Value Per Short Ton
Plaster and gunite sands	$3.79
Concrete aggregate	$3.54
Asphaltic concrete	$3.46
Railroad ballast	$3.33
Concrete products	$2.97
Other	$2.92
Road base and coverings	$2.32
Snow and ice control	$2.10
Fill	$1.69
Total or average	$2.73

Consumption:

In 1982, the last year of record, the leading uses for sand and gravel were road base and coverings, concrete aggregate, and fill (see Table 2)

TABLE 2
USES OF SAND
AND GRAVEL PRODUCED IN NEW YORK, 1982
("1982, U.S. Bureau of Mines and Minerals Yearbook")

Use	Quantity	
	M Short Tons	Percent
Road and coverings	5.04	28.8
Concrete aggregrate	4.19	23.9
Fill	2.80	16.0
Asphaltic concrete	2.70	15.4
Snow and ice control	1.37	7.8
Concrete products	0.80	4.6
Other	0.41	2.4
Plaster and gunite sands	0.16	0.9
Railroad ballast	0.04	0.2
Total	17.52*	100.0

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* Total does not equal 17.52 due to rounding.

CRUSHED ROCK

Production:

Crushed rock is the leading nonfuel mineral produced in New York. In 1984, 33.8M short tons of crushed rock was produced, valued at $53.4M and representing 26% of the state's nonfuel mineral production.

The state is a leading producer in the U.S. In 1983, it ranked eighth in value and eleventh in volume.

Unlike sand and gravel, crushed rock production has grown, although slowly during the 1980's. Between 1981 and 1984, annual growth was 2.5% (compounded). Production is still below the 1979 peak of 37.0M short tons.

In 1983, 48 companies operated 78 quarries in 36 of the state's 62 counties. Leading production counties were, in order, Onondaga, Rockland, Dutchess, Erie and Niagara. Leading companies were:

The General Crushed Stone Co. (subsiduary of Koppers Co. Inc.) of Watertown, Honeoye Falls, Skaneateles, Geneva and Sodus;
New York Trap Rock Corp. (subsiduary of Lone Star Inc.) of Clinton Point and West Nyack;
Allied Chemical of Boonville and Jamesville;
Fitzgerald Bros. Construction Co. of Troy;
and Concrete Materials Inc. of Manchester and Brockport.

Almost 89% of crushed stone produced in 1983 was limestone. The remaining 11% was contributed by traprock, sandstone, granite, and dolomite.

Value:

In 1984, the average value of crushed rock produced in the state was $4.11 per short ton, an increase of 7% from the 1981 value ($3.84).

Value depends upon end use. As shown in Table 3, the highest value uses were agricultural limestone, bituminous surface-treatment aggregate, macadam, and bituminous aggregate.

TABLE 3

UNIT VALUE OF CRUSHED STONE PRODUCTS FOR END USES, NEW YORK , 1983

("1983, U.S. Bureau of Mines and Minerals Yearbook")

Use	Value Per Short Ton
Coarse aggregate (over 1.5 inch)	
- macadam	$5.70
- riprap and jetty stone	4.83
- filter stone	3.59
Coarse aggregate, graded	
- concrete aggregate	$3.81
- bituminous aggregate	5.93
- bituminous surface-treatment aggregate	7.58
- railroad ballast	4.26
Fine aggregate (under 0.375 inch)	
- concrete stone sand	$4.46
- bituminous mix or seal stone sand	4.30
- undesignated screening	4.37
Coarse and fine aggregate	
- graded road base and subbase	$3.90
- unpaved road surfacing	4.66
- crush run or fill or waste	3.56
- other coarse and fine aggregate	-

TABLE 3 (continued)

Use	Value per Short Ton
Agricultural limestone	8.57
Special: Roofing granules	-
Other (incl. cement manufacture drain fields, flux stone, uses left blank above)	3.74
Average	$4.27

Consumption:

In 1983, the main uses for crushed rock were coarse bituminours aggregate, grade road base or subbase, crusher run or fill or waste, and coarse conrete aggregate. (See Table 4)

MARKET INTELLIGENCE

Government officials in New York are very concerned about the control and effects of "acid rain". Reducing "acid rain" damage to lakes often involves the use of limestone or lime. As a result, there is great potential for limestone producers in the state.

TABLE 4
USES FOR CRUSHED STONE PRODUCED IN NEW YORK, 1983
("1983, U.S. Bureau of Mines and Minerals Yearbook")

	Quantity	
Use	M Short Tons	Percent
Coarse aggregate (over 1.5 inch)		
- macadam	0.17	0.5
- riprap and jetty stone	0.50	1.5
- filter stone	0.08	0.3
Coarse aggregate, graded		
- concrete aggregate	2.09	6.5
- bituminous aggregate	4.45	13.8
- bituminous surface-treatment aggregate	0.85	2.6
- railroad ballast	0.22	0.7
Fine aggregate (under 0.375 inch)		
- concrete stone sand	0.28	0.9
- bituminous mix or seal stone sand	0.64	2.0
- undesignated screening	0.04	0.1
Coarse and fine aggregate		
- graded road base and subbase	4.58	14.2
- unpaved road surfacing	1.31	4.1
- crush run or fill or waste	2.87	8.9
- other coarse and fine aggregate	-	-

TABLE 4 (continued)

Use	Quantity M Short Tons	Percent
Agricultural limestone	0.21	0.6
Special: Roofing granules	-	-
Other (incl. cement manufacture drain fields, flux stone, uses left blank above)	14.05	43.4
Average	32.34	100.0*

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* Percent totals do not equal 100.0 due to rounding.

NEW JERSEY
SAND AND GRAVEL

Production:

New Jersey's production of sand and gravel oscillated during the early 1980s as shown in Table 1. In 1984, sand and gravel represented 17 percent of the state's nonfuel mineral value.

Sixteen of the state's twenty-one counties produced sand and gravel in 1983. The leading production counties were Ocean, Morris, Camden, and Middlesex. These counties are close to markets.

Over 50 companies produced sand and gravel from 58 quarries in 1983. Major producers were:
Dallenbach Sand Co. Inc. of Dayton;
Ralph Clayton and Sons of Lakewood;
Stavola Sand and Gravel Inc. of Red Bank;
Jesse S. Morie and Son Inc. of Hammonton, Mauricetown and Clayville;
Whitehead Brothers Co. of Port Elizabeth; and
George Pellinos Inc. of Williamstown.

Value:

In 1984, sand and gravel produced in the state was worth an average of $3.22 per short ton. That value is 21 percent higher than the 1981 value ($2.67).

The variation in value with end use (1982) is detailed in Table 2. The highest value uses in 1982 were "other" (or miscellaneous) uses, snow and ice control and concrete aggregate.

Consumption:

In New Jersey, the primary end uses for sand and gravel are concrete aggregate, fill, asphaltic concrete, and road base and coverings as illustrated in Table 3.

TABLE 1
QUANTITY AND VALUE OF SAND AND GRAVEL PRODUCED IN NEW JERSEY, 1981-1984
("US BUREAU OF MINES MINERALS YEARBOOK")

	Production	
Year	Quantity, M Short Tons	Value, M$
1981	9.8	26.0
1982	7.9	25.7
1983	10.8	34.3
1984	8.1	26.1

TABLE 2

UNIT VALUE OF SAND AND GRAVEL PRODUCTS FOR END USES, NEW JERSEY, 1982

("1982 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Value, per Short Ton
Other	$4.51
Snow and ice control	3.70
Concrete aggregate	3.69
Plaster and gunite sands	3.44
Concrete products	3.38
Road base and coverings	2.95
Asphaltic concrete	2.86
Fill	2.56
Average	$3.24

TABLE 3

USES OF SAND AND GRAVEL PRODUCED IN NEW JERSEY, 1982

("1982 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Quantity M Short Tons	Percent
Concrete aggregate	2.77	34.8
Fill	1.40	17.6
Asphaltic concrete	1.24	15.6
Road base and coverings	0.95	12.0
Plaster and gunite sands	0.76	9.6
Concrete products	0.47	5.9
Snow and ice control	0.24	3.0
Other	0.11	1.3
Total	7.94	100.0*

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* Total does not equal 100.0 due to rounding

CRUSHED ROCK

Production:

Crushed rock production has increased regularly through the 1980s from 10.4 M short tons in 1981 to 13.2 M short tons in 1984, an increase of 6 percent per year compounded. In 1984, production was valued at $75.0, worth 48 percent of New Jersey's nonfuel mineral production.

Eight of 21 counties produced crushed rock in 1983: Somerset, Passaic, Sussex and Mercer--which produced approximately 75 percent--and Essex, Hunterdon, Morris and Hudson. Rock types crushed included traprock (basalt), granite, and limestone. Traprock represented a the largest part of production.

Leading producers were:
Anthony Ferrante and Sons Inc. (granite) of Bernardsville;
Tri-County Asphalt Corp. (granite) of Hopatcong;
Riverdale Quarry (granite) of Riverdale;
Little Ferry Asphalt Corp. (traprock) of Clifton;
Stavda Construction Materials Inc. (traprock) of Red Bank;
Telcon Warren Quarries Inc. of Prospect Park; and
Trap Rock Industries Inc. (traprock) of Kingston, Lambertville.

Value:

The average unit value for crushed rock in New Jersey was $5.68 per short ton in 1984. That price represented only a 2.5 percent increase from the 1981 price of $5.54.

Table 4 presents the variation in unit value with end use. The highest value uses were "other" (including agricultural limestone, terrzzo, acid water treatment, etc.), bituminus surface treatment aggregate, unpaved road surfacing, fine aggregate and graded road base or subbase.

TABLE 4
UNIT VALUE OF CRUSHED ROCK PRODUCTS FOR END USES, NEW JERSEY, 1983
("1983 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Value, per Short Ton
Coarse aggregate (over 1.5 inch)	
- coarse concrete aggregate	$4.95
- coarse bituminous aggregate	5.13
- bituminous surface treatment aggregate	5.88
- railroad ballast	5.38
Fine aggregate (under 0.375 inch)	
- concrete stone sand	2.97
- undesignated screening	5.18
- other fine aggregate	5.78
Coarse and fine aggregate	
- graded road base or subbase	5.44
- unpaved road surfacing	5.60
- crusher run or fill or waste	4.63
- other coarse and fine aggregate	6.84
Average	5.72

Consumption:

The main uses for crushed rock are "other" (including agricultural limestone, terrazzo, acid water treatment, ec.), coarse concrete aggregate, graded road base or subbase, and corase bituminous aggregate (see Table 5.)

MARKET INTELLIGENCE

Pit and quarry development is meeting resistance in New Jersey. In 1983, two townships (Readington and Amwell) in Hunterdon County moved to prevent the development of mineral resources. As well, objections were raised to the disposal of dredged material in an old quarry due to concerns about environmental risks (1982).

TABLE 5
USES FOR CRUSHED ROCK PRODUCED IN NEW JERSEY, 1983
("1983 US BUREAU OF MINES MINERALS YEARBOOK")

	Quantity	
Use	M Short Tons	Percent
Coarse aggregate (over 1.5 inch)		
- coarse concrete aggregate	1.80	14.6
- coarse bituminous aggregate	1.40	9.3
- bituminous surface treatment aggregate	0.24	2.0
- railroad ballast	0.03	0.2
Fine aggregate (under 0.375 inch)		
- concrete stone sand	0.25	2.0
- undesignated screening	0.46	3.7
- other fine aggregate	0.98	8.0
Coarse and fine aggregate		
- graded road base or subbase	1.80	14.6
- unpaved road surfacing	0.35	2.8
- crusher run or fill or waste	0.04	0.3
- other coarse and fine aggregate	0.83	6.8
Other	4.00	32.5
Total	12.30*	100.0*

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* Total does not equal 12.30 due to rounding.

** Total does not equal 100.0 due to rounding.

PENNSYLVANIA
SAND AND GRAVEL

Production:

In 1984, Pennsylvania produced an estimated 13.2M short tons of sand and gravel. Valued at $57.0M, the sand and gravel represented 9 percent of the state's nonfuel mineral production and was the fourth leading mineral category.

Production increased in 1984 after four straight years of decline. In 1983, production was 11.8M short tons about 7.2M short tons below 1979 production.

Sand and gravel was produced in 34 of the state's 67 counties in 1983. The producting counties were located northwest and east of the Appalachian Mountains with no production near either Pittsburgh or Philadelphia. In the west of the state, leading counties were Armstrong, Beaver and Erie, in the east, Bucks, Columbia and Lycoming.

At one time, much of the sand and gravel was dredged from the state's rivers and streams, especially in the west. However, environmental constraints have greatly reduced dredging.

Major producers in 1983 included:

Davison Sand and Gravel Co. of Tarrtown, New Kensington and Connelsville;
Dravo Corp. of Georgetown and Wellsburgh; and
Warner Co. of Morrisville, Bellefonte, Torrences.

These three firms together produced 32 percent of Pennsylvanias sand and gravel. Other large producers were Tionesta Sand and Gravel Co. of West Hickory, Cooperstown, Garland and Russell, and H.W. Cooper and Sons Inc. of Slippery Rock. Most of the large producers had quarries and pits located as near major population centres as possible.

The state's production is highly centralized. In 1982, almost 80 percent of state production came from 37 pits which yielded between 0.1 and 1.0M short tons annually. One pit produced over 1.0 short tons. The remaining 20 percent of production came from 85 pits which yielded under 0.1M short tons.

Value:

In 1984, the average unit value of sand and gravel was $4.32 per short ton, this presented a drop from the 1981 unit value of $4.36. The highest value end uses for sand and gravel in 1982 were asphaltic concrete, concrete products, plaster and gunite sands, and concrete aggregate (See Table 1).

Consumption:

The primary end uses for sand and gravel in Pennsylvania are concrete aggregate, road base and coverings, asphaltic concrete, and concrete produces (See Table 3).

TABLE 1

UNIT VALUE OF SAND AND GRAVEL PRODUCTS FOR END USES IN PENNSYLVANIA, 1982

("1982, U.S. Bureau of Mines and Minerals Yearbook")

Use	Unit Value, Per Short Ton
Asphaltic concrete	$5.20
Concrete products	4.95
Plaster and gunite sands	4.66
Concrete aggregate	4.53
Other	4.50
Snow and ice control	3.84
Railroad ballast	3.50
Road base and coverings	3.37
Fill	2.46
AVERAGE	$4.24

TABLE 3
USES OF SAND AND GRAVEL PRODUCED IN PENNSYLVANIA, 1982
("1982, U.S. Burea of Mines and Minerals Yearbook")

Use	Quantity M Short Tons	Quantity Percent
Concrete aggregate	4.56	34.8
Road base and coverings	3.35	25.6
Asphaltic concrete	2.41	18.4
Concrete products	1.11	8.5
Fill	0.89	6.8
Plaster and gunite sands	0.36	2.8
Other	0.21	1.6
Snow and ice control	0.17	1.3
Railroad ballast	0.02	0.2
TOTAL	13.08	100.0

CRUSHED ROCK

Production:

Crushed rock production increased in 1983 and 1984 after four years of decline. During the decline production fell from 74.1M short tons (1979) to 50.4M short tons (1982). Production in 1984 was 56.2M short tons, valued at $232.0 and worth 35 percent of the state's nonfuel mineral production.

Of 67 counties, 50 produced curshed rock in 1983. Production was concentrated in thirteen counties in the southeast (70 percent of state production) ranging from 4.6M short tons in Montgomery to 1.1M short tons in Cumberland.

Seventeen counties in all produced over 1.0M short tons each.

The top producers in 1983 were:

New Enterprise Stone and Lime Co. of New Enterprise, Everett, Boswell and Cairnbrook;
Koppers Co. of Easton;
Bethlehem Steel Corp of Annville;
Warner Co. of Bellefonte; and Stabler Co. of Wescosville.

They accounted for approximately 33 percent of total production.

Of the state's 183 quarries in 1983, nine yielded over 1.0M short tons and accounted for about 25 percent of total output.

Value:

In 1984, the average unit value for crushed rock was $4.13 per short ton. This represented an increase of 6 percent from the 1981 value of $3.90.

TABLE 4
UNIT VALUE OF CRUSHED ROCK PRODUCTS FOR END USES
PENNSYLVANIA, 1983
("1983, U.S. Bureau of Mines and Minerals Yearbook")

Use	Value Per Short Ton
Coarse aggregate (over 1.5 inch)	
Macadam	$3.70
Riprap and jetty stone	4.50
Filter stone	3.97
Coarse aggregate, graded	
Concrete aggregate, coarse	4.14
Bituminous aggregate, coarse	4.20
Bituminous surface treatment aggregate	4.00
Railroad ballast	3.66
Fine aggregate (under 0.375 inch)	
Stone sand, concrete	4.31
Stone sand, bituminous mix or seal	5.20
Screening, undesignated	3.75
Other fine aggregate	4.78
Coarse and fine aggregate	
Graded road base or subbase	3.77
Unpaved road surfacing	3.68
Crusher run or fill or waste	3.64
Other construction materials	3.92

TABLE 4 (continued)

Use	Value, Per Short Ton
Agricultural	
Agricultural limestone	$ 7.85
Poultry grit and mineral food	12.79
Other agricultural uses	4.50
Chemical and metallurgical	
Cement manufacture	3.49
Lime manufacture	5.79
Flux stone	6.04
Glass manufacture	11.67
Special	
Mine dusting or acid water treatment	18.74
Asphalt fillers or extenders	10.66
Other fillers or extenders	15.26
Other	4.25
AVERAGE	$ 4.40

Consumption:

The uses for crushed rock are "Special: Other" (including terrazzo, whiting, roofing granules, large coarse aggregate, etc.), unpaved road surfacing, graded road base or subbase, cement manufacture, coarse bituminous aggregate, coarse concrete aggregate, and other fine aggregate (See Table 5).

MARKET INTELLIGENCE

Pennsylvania has experienced conflicts between quarry operators and the general public. In 1983, citizens of Cumberland and Berks counties objected to expansions by Hempt Bros. and Warner Cos. respectively.

The downturn in the state's steel industry has reduced the production of slag. In 1983, Standard Slag Co. opened a new crushed stone quarry in Somerset county. Another new quarry was opened by J.M. Brenner in southeastern Pennsylvania in 1983.

TABLE 5
USES FOR CRUSHED ROCK PRODUCED IN PENNSYLVANIA, 1983
("1983, U.S. Bureau of Mines and Minerals Yearbook")

Use	Quantity M Short Tons	Percent
Coarse aggregate (over 1.5 inch)		
Macadam	0.30	0.6
Riprap and jetty stone	0.25	0.5
Filter stone	0.18	0.4
Coarse aggregate, graded		
Concrete aggregate, coarse	3.51	6.8
Bituminous aggregate, coarse	3.61	7.0
Bituminous surface treatment aggregate	1.63	3.2
Railroad ballast	1.15	2.2
Fine aggregate (under 0.375 inch)		
Stone sand, concrete	0.84	1.6
Stone sand, bituminous mix or seal	1.22	2.4
Screening, undesignated	0.80	1.6
Other fine aggregate	3.38	6.6
Coarse and fine aggregate		
Graded road base or subbase	6.70	13.0
Unpaved road surfacing	7.00	13.6
Crusher run or fill or waste	1.45	2.6
Other construction materials	0.05	0.1
Agricultural		
Agricultural limestone	1.74	3.4
Poultry grit and mineral food	0.06	0.1
Other agricultural uses	0.03	0.1

TABLE 5 (continued)

Use	Quantity M Short Tons	Percent
Chemical and metallurgical		
Cement manufacture	5.88	11.4
Lime manufacture	2.20	4.3
Flux stone	1.45	2.8
Glass manufacture	0.04	0.1
Special		
Mine dusting or acid water treatment	0.12	0.2
Asphalt filelrs or extenders	0.16	0.3
Other fillers or extenders	0.35	0.7
Other	7.41	14.4
TOTAL	51.52*	100.0

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* Total does not equal 51.52 due to rounding.

DELAWARE
SAND AND GRAVEL

There are only two nonfuel mineral products produced in Delaware: sand and gravel and magnesium compounds. Much of the state's aggregate needs are met by imports from Maryland and Pennsylvania (20-70 miles away). Delaware has an abundance of sand and gravel deposits but the deposits cannot be developed because of conflicts with agriculture and development.

Production: Delaware's sand and gravel production dropped in 1984, falling to 1.2 M short tons from 1.4 M short tons in 1983. Through the 1980s, production has ranged from 1.2 to 1.4 M short tons.

In 1983, there were forty pits in continuous or intermittent use in the state. Sand and gravel was produced in the state's three counties with Newcastle County in the north leading in production. Eight companies operated eight pits in the state with two in Newcastle County, five in Kent county and one in Sussex County. Pit size varied greatly: two pits produced less than 0.025 M short tons, two between 0.025 and 0.050 M short tons, one between 0.050 and 0.100 M short tons, two between 0.200 and 0.300 M short tons and one between 0.600 and 0.700 M short tons.

Principal producers are:

Contractors Sand and Gravel Co. of Wilmington
Dover Equipment and Machine Co. of Dover
Parkway Gravel Inc. of Newcastle.

Value: In 1984, average unit value of sand and gravel was $2.50 per short ton, a minimal increase from the 1981 value of $2.46. As seen in Table 1, there was relatively little variation in unit value among end uses.

TABLE 1

UNIT VALUE OF SAND AND GRAVEL PRODUCTS FOR END USES, DELAWARE, 1982

("1982 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Value, per Short Ton
Plaster and gunite sand	$3.69
Concrete products	3.25
Other	3.15
Asphaltic concrete	3.13
Concrete aggregate	2.73
Road base and coverings	2.20
Fill	2.15
Average	$2.46

Consumption:

The largest uses of sand and gravel in Delaware are road base and coverings and concrete aggregate (see Table 2).

Crushed Stone:

There is no crushed stone industry in Delaware. Due to urban buildup and suburban growth, there is little space to accommodate crushed stone quarrying operations. The last quarry in Delaware was closed in 1968. All crushed stone is imported from Virginia and Delaware.

TABLE 2
USES OF SAND AND GRAVEL PRODUCED IN DELAWARE, 1982
("1982 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Quantity	
	M Short Tons	Percent
Road base and coverings	0.75	57.8
Concrete aggregate	0.34	26.1
Other (incl. concrete products and asphaltic concrete)	0.11	8.5
Fill	0.06	4.8
Plaster and gunite sands	0.04	2.8
Concrete products	*	*
Asphaltic concrete	*	*
Total	1.30	100.0

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* Included in "other" figures

MARYLAND
SAND AND GRAVEL

Production:

Production increased in 1984 for the third consecutive year, reaching 12.6M short tons up 19 percent from 1983 production (10.6M short tons). The value of 1984 production was $49.1M up 30 percent from 1983 and representing 21 percent of Maryland's nonfuel mineral production.

Thirteen of the state's 23 counties produced sand and gravel in 1982. There were 35 companies operating 48 pits. Major producers were:

Charles County Sand and Gravel Co. of Waldorf and Leonardstown;
Contee Sand and Gravel Co. Inc. of Annapolis Junction;
Genstar Stone Products Co. of Frederick;
J.E. Ownes, III of Davidsonville;
York Building Products Co. Inc. (Mason Dixon Division) of Perryville.

Value:

In 1984, the average unit value of sand and gravel produced in Maryland was $3.90, this represented an increase of 17 percnet over the 1981 value ($3.35).

The variation in unit value with end use is presented in Table 1. The highest value uses in 1982 were "other", (or miscellaneous) concrete aggregate, concrete products and asphaltic concrete.

TABLE 1
UNIT VALUE OF SAND AND GRAVEL PRODUCTS FOR END USES, MARYLAND, 1982
("1982, U.S. Bureau of Mines and Minerals Yearbook")

Use	Unit Value, per Short Ton
Other (miscellaneous)	$4.05
Concrete aggregate	3.61
Concrete products	3.21
Asphaltic concrete	3.01
Road base and coverings	2.87
Fill	2.65
Snow and ice control	2.41
AVERAGE	$3.33

TABLE 2
USES OF SAND AND GRAVEL
PRODUCED IN MARYLAND, 1982
("1982, U.S. Bureau of Mines and Minerals Yearbook")

Use	Quantity	
	M Short Tons	Percent
Concrete aggregate	4.77	49.0
Asphaltic concrete	1.73	17.8
Concrete products	1.02	10.5
Road base and coverings	0.88	9.1
Fill	0.84	8.7
Other	0.48	4.9
Snow and ice control*	-	-
TOTAL	9.72	100.0

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* 2000 short tons.

Consumption:

The primary end uses for sand and gravel are concrete aggregates, asphaltic concrete, and concrete products as illustrated in Table 2 for 1982.

CRUSHED ROCK

Production:

In 1984, Maryland's crushed rock production reached 21.3M short tons. This was the second consecutive year growth and represented an increase of 10 percent over 1983 production (19.3M short tons).

The value of 1984 production was $92.0, up from 1983. The 1984 value represented almost 40 percent of the state's nonfuel mineral production.

Crushed rock was produced in ten of the state's 23 counties in 1983. The leading producer was Baltimore county at 29 percent of the total.

In 1983, approximately 60 percent of the production was from marble and metalimestone, 20 percent from limestone, 10 percent from granites and gneiss, and 10 percent from sandstone, traprock, quartzite and other metamorphic rocks. In addition oyster shells were dredged from Chesapeake Bay and crushed fro aggregate.

Twenty companies operated 29 quarries in the state. The principal producers were:

Genstar Stone Products Corp (largest) of Frederick and Texas;
The Arundel Corp of Baltimore and Havre Degrace;
Rockville Crushed Stone Inc. of Rockville;
D.M. Stoltzfus and Son of Conowingo.

Stoltzfus markets to Virginia, New Jersey, and Delaware from its plant. Genstar made a large expansion ($13M) to its Frederick plant in 1983.

Value:

In 1984, the average unit value of crushed rock was $4.32. This represented a drop of 4 percent from the 1981 value of $4.51.

Table 3 presents unit values for several end uses. The highest value uses in 1983 were "special: other" (including agricultural limestone, filter stone, fulx stone, whiting, etc.), concrete stone sand, unpaved road surfacing, and reprap and jetty stone.

MARKET INTELLIGENCE

Maryland has experienced substantial public opposition to the development and expansion of aggregate pits and quarries. Reasons cited by opponents include zoning, blast damage, truffic traffic and risk to the environment.

TABLE 3
UNIT VALUE OF CRUSHED ROCK PRODUCTS FOR END USES
MARYLAND, 1983
("1983, U.S. Bureau of Mines and Minerals Yearbook")

Use	Value Per Short Ton
Coarse aggregate (+1-½ inch)	
Macadam	$ 3.17
Riprap and jetty stone	4.62
Coarse aggregate, graded	
Concrete aggregate, coarse	3.50
Bituminous aggregate, coarse	4.21
Bituminous surface treatment aggregate	4.31
Railroad ballast	3.53
Fine aggregate (-3/8 inch)	
Stone sand; concrete	6.69
Stone sand; bituminous mix or seal	3.48
Coarse and fine aggregate	
Graded road base or subbase	4.42
Unpaved road surfacing	4.68
Crusher run or fill or waste	3.09
Chemical and metallurgical	
Cement manufacture	1.91
Lime manufacture	3.78
Special: Other	11.09
AVERAGE	$ 4.17

Consumption:

As seen in Table 4, using 1983 data, the main end uses for Maryland crushed rock are: unpaved road surfacing, coarse concrete aggregate, cement manufacture, coarse bituminous aggregate and macadam.

TABLE 4

USES FOR CRUSHED ROCK
PRODUCED IN MARYLAND, 1983

("1983, U.S. Bureau of Mines and Minerals Yearbook")

Use	Quantity M Short Tons	 Percent
Coarse aggregate (over 1.5 inch)		
Macadam	1.93	10.0
Riprap and jetty stone	0.40	2.1
Coarse aggregate, graded		
Concrete aggregate, coarse	2.92	15.1
Bituminous aggregate, coarse	2.21	11.5
Bituminous surface treatment aggregate	0.31	1.6
Railroad ballast	0.07	0.3
Fine aggregate (under 0.375 inch)		
Stone sand, concrete	0.16	0.8
Stone sand, bituminous mix or seal	0.67	3.5
Coarse and fine aggregate		
Graded road base or subbase	1.83	9.5
Unpaved road surfacing	4.17	21.6
Crusher run or fill or waste	1.24	6.4
Chemical and metallurgical		
Cement manufacture	2.28	11.8
Lime manufacture	0.01	0.1
Special: Other	1.10	5.7
TOTAL	19.28*	100.0

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* Total does not equal 19.28 due to rounding.

VIRGINIA
SAND AND GRAVEL

Virginia's sand and gravel production was 8.3 M short tons in 1984. This was a 15 percent increase over 1983 production (7.2 M short tons) and represented the second consecutive increase since the 1982 recession.

The 1984 production was valued at $41.8 M, worth 10 percent of the state's nonfuel mineral production.

In 1983, the Virginia Division of Mineral Resources listed 131 producers in the state. In 1982, the US Bureau of Mines received reports from 45 companies working 58 deposits in 34 counties-cities. Of these, the top ten counties-cities produced 88 percent of sand and gravel in the state. Production was centered in three areas of eastern Virginia. The leading area was in the southeast. There, Charles City, Chesterfield, Henrico, and Prince George, yielded 54 percent of the state's production. Next in production were the four northeastern counties of Caroline, King George, Spotsylvania, and Stafford. The third area was located in the cities of Chesapeake and Virginia Beach on the Atlantic coast.

Leading producers included:

Lone Star Industries Inc. of Richmond and Petersburg;
Sadler Materials Corp. of Varina;
Unimen Corp. of Gore; and
West Sand and Gravel Co. Inc. of Richmond.

Value:

The average unit value of sand and gravel produced in 1984 was $3.83 per short ton. This value was 11 percent below the 1983 value ($4.28) and was the first decline in four years.

There is a significant variation in value with end use with concrete products, concrete aggregate and road base and coverings being the highest value uses (see Table 1).

Consumption:

The primary uses for sand and gravel in 1982 were concrete aggregate, concrete products, and fill (see Table 2).

CRUSHED ROCK

Production:

For the second year, crushed rock production increased in 1984, reaching 42.3 M short tons. That production represented an increase of 11 percent over 1983 (38.0 M short tons). The 1984 production was valued at $169 M, a 6 percent increase over 1983. Crushed rock value represented 53 percent of nonfuel mineral product in Virginia in 1984.

In 1983 there were sixty companies operating 98 quarries and crushing plants. At least 44 counties and cities had quarries in 1983. Leading producers were:

Lone Star Industries Inc. of Chester and Petersburg
Vulcan Materials of Lawrenceville, Manassas, Occoquan, South Boston, Briston, Chatham and Goochland
Daniel Construction of Mountain Grove
Blue Ridge Stone Co. of Rustburg
W.S. Frey of Clearbrook
General Crushed Stone of Doswell
Chantilly Crushed Stone of Chantilly
Vulcan Materials of Manassas
Rocky Dale Quarries of Roanoke
James River Hydrated and Supply of Swords Creek
Greer Lime Co. of Saltville
Luck Stone Corp. of Charlottesville, Staunton, Centreville and Goochland

TABLE 1
UNIT VALUE OF SAND AND GRAVEL PRODUCTS FOR END USES, VIRGINIA, 1982
("1982 US BUREAU MINES MINERALS YEARBOOK")

Use	Unit Value, per Short Ton
Concrete products	$5.38
Concrete aggregate	4.37
Road base and coverings	4.26
Other	3.68
Plaster and gunite sands	3.45
Asphaltic concrete	3.12
Snow and ice control	2.51
Fill	1.92
Average	4.09

TABLE 2
USES OF SAND AND GRAVEL
PRODUCED IN VIRGINIA, 1982
("US BUREAU OF MINES MINERALS YEARBOOK")

Use	Quantity M Short Tons	Percent
Concrete aggregate	3.11	44.6
Concrete products	1.35	19.3
Fill	1.03	14.8
Road base and coverings	0.72	10.3
Asphaltic concrete	0.41	5.9
Other (incl. both categ. below)	0.35	5.0
Snow and ice control	-	-
Plaster and gunite sand	-	-
Total	6.98*	100.0**

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* Total does not equal 6.98 due to rounding

** Total does not equal 100.0 due to rounding

Value:

The average unit value for crushed rock in Virginia in 1984 was $4.00 per short ton. This value was lower than that of any of the three previous years ($4.18 in 1983, $4.04 in 1982, $4.12 in 1981).

Variation in value with end use is presented in Table 3. The highest value end uses, based on 1983 data, are special--mine dusting or acid water treatment, agricultural limestone, terrazzo/ exposed aggregate, lime manufacture, and riprap and jetty stone.

Consumption:

The largest use category by far according to 1983 figures, is coarse and fine aggregates followed by graded coarse aggregate (see Table 4).

MARKET INTELLIGENCE

There has been considerable conflict between the public and crushed stone operators in Virginia. In 1982, residents of Loudoun and Roanoke counties protested expansions by quarry operators.

TABLE 3
UNIT VALUE OF CRUSHED ROCK PRODUCTS FOR END USES
VIRGINIA (1983)
("1983 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Value per Short Ton
Coarse aggregate (over 1.5 inch)	
Macadam	$3.14
Riprap and jetty stone	5.35
Filter stone	3.40
Other	*
Coarse aggregate, graded	
Concrete aggregate, coarse	4.49
Bituminous aggregate, coarse	4.45
Bituminous surface treatment aggregate	4.54
Railroad ballast	3.47
Other	*
Fine aggregate (under 0.375 inch)	
Stone sand	
Concrete	4.46
Bituminous mix or seal	3.27
Screening, undesignated	3.92
Other	*
Coarse and fine aggregate	
Graded road base or subbase	3.96
Unpaved road surfacing	3.97
Terrazzo and exposed aggregate	6.17
Crusher run or fill or waste	3.55
Agricultural	
Agricultural limestone	7.79
Poultry grit and mineral food	*
Other	*
Chemical and metallurgical	
Cement manufacture	1.59
Lime manufacture	6.00
Ferrosilicon	*
Flux stone	2.98
Glass manufacture	*
Sulfur oxide removal	*
Special	
Mine dusting or acid water treatment	8.08
Asphalt fillers or extenders	*

TABLE 3 (continued)

Use	Unit Price, per Short Ton
Other fillers or extenders	1.40
Roofing granules	*
Other	4.26
Average	4.18

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* Data withheld, included under "special: other"
** Total does not equal 100.0 due to rounding

TABLE 4
USES FOR CRUSHED ROCK PRODUCED IN VIRGINIA, 1983
("1983 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Quantity M Short Tons	Percent
Coarse aggregate (+1½ inch)		
Macadam	0.20	0.5
Riprap and jetty stone	0.37	1.0
Filter stone	0.12	0.3
Other	*	*
Coarse aggregate, graded		
Concrete aggregate, coarse	4.60	12.1
Bituminous aggregate, coarse	4.09	10.8
Bituminous surface treatment aggregate	2.14	5.6
Railroad ballast	1.19	3.1
Other	*	*
Fine aggregate (-3/8 inch)		
Stone sand		
Concrete	1.04	2.7
Bituminous mix or seal	0.16	0.4
Screening, undesignated	0.58	1.5
Other	*	*
Coarse and fine aggregate		
Graded road base or subbase	8.33	21.9
Unpaved road surfacing	1.52	4.0
Terrazzo and exposed aggregate	0.01	0.0
Crusher run or fill or waste	4.98	13.1
Agricultural		
Agricultural limestone	0.90	2.4
Poultry grit and mineral food	*	*
Other	*	*
Chemical and metallurgical		
Cement manufacture	1.28	3.4
Lime manufacture	0.46	1.2
Ferrosilicon	0.09	-
Flux stone	0.07	0.2

TABLE 4 (continued)

Use	Quantity M Short Tons	Percent
Glass manufacture	*	*
Sulfur oxide removal	*	*
Special		
Mine dusting or acid water treatment	0.18	0.5
Asphalt fillers or extenders	*	*
Other fillers or extenders	0.11	0.3
Roofing granules	–	–
Other	5.56	14.6
TOTAL	37.96	100.0**

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* Data withheld, included under "special: other"

** Total does not equal 100.0 due to rounding

NORTH CAROLINA
SAND AND GRAVEL

Production:

Sand and gravel production increased for the second consecutive year in 1984 with a total of 5.9 M short tons. Production was up 5 percent over 1983 (5.6 M short tons) and 13 percent over the recession year of 1982 (5.2 short tons). However, it is still below prerecession levels (1981, 6.3 M short tons).

The value of 1984 production was $16.5 M, down 2 percent from 1983. Sand and gravel represented 4 percent of the state's nonfuel mineral production.

There was production in 50 of the state's 100 counties. In total, there were 100 operations. The top 10 producing counties produced in excess of 66 percent of North Carolina's sand and gravel. Almost 25 percent of total production came from an area encompassing Cumberland and Harnett counties (south central). Another 25 percent came from another south central area consisting of Anson, Montgomery, and Richmond counties. The western portion (Buncane, Haywood, McDowell, and Yancey counties) yielded about 13 percent of the total and Wayne County in the east central portion produced about 3 percent of North Carolina's sand and gravel.

Leading producers were:

B. V. Hedrick Gravel and Sand Co. of Lilesville and Grove Stone;
W. R. Bonsal Co. of Lilesville; and
Becker Sand and Gravel of Bunnlevel, Lellington and Fayetville.

Value:

In 1984, the average unit value of sand and gravel produced in the state was $2.80. That value was lower than any of the three previous years ($3.02 in 1983, $2.96 in 1982, and $2.9 in 1981).

Table 1 presents the variation in unit value with end use based on 1983 data. The highest value uses were snow and ice control, concrete aggregate, and asphaltic concrete.

Consumption:

In North Carolina, the largest single use for sand and gravel is concrete aggregate with other primary uses being asphaltic concrete, fill, and road base and covering (based on 1982 data).

TABLE 1
UNIT VALUE OF SAND AND GRAVEL PRODUCTS FOR END USES, NORTH CAROLINA, 1982
("1982 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Value, Per Short Ton
Snow and ice control	$4.03
Concrete aggregate	3.18
Asphaltic concrete	3.12
Plaster and gunite sands	3.09
Other	3.04
Concrete products	3.00
Road base and coverings	2.64
Fill	1.56
Average	$2.96

TABLE 2
USES OF SAND AND GRAVEL
PRODUCED IN NORTH CAROLINA, 1982
("1982 US BUREAU OF MINES MINERALS YEARBOOK")

Use	QUANTITY M Short Tons	Percent
Concrete aggregate	2.86	55.0
Asphaltic concrete	0.99	19.0
Fill	0.48	9.2
Road base and coverings	0.47	9.0
Plaster and gunite sands	0.21	4.0
Concrete products	0.13	2.5
Other	0.05	1.0
Snow and ice control	0.01	0.2
Total	5.20	100.0*

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* Total does not equal 100.0 due to rounding

CRUSHED STONE

Production:

Crushed stone production increased for the second straight year in 1984. At 35.5 M short tons, 1984 production was 5 percent over 1983 production (33.7 M short tons), 29 percent over 1982 production, (27.5 M short tons) and 23 percent over 1981 production (28.8 M short tons).

The value of 1984 production was $146.0 M, only 0.2 percent over the 1983 value ($145.6 M) but 24 percent over the 1982 value ($117.6). Crushed stone contributed 34 percent of the value of North Carolina's nonfuel mineral production.

Crushed stone was produced in fifty of the state's 100 counties. Table 4 presents crushed production by type and value. North Carolina ranked second in crushed granite production.

The top producers were:

Martin Marietta Corp. of Woodleaf, Fountain, Reidsville, Hickory, New Bern, Pomona, Charlotte, Arrowood, Kings Mountain, Castte Hayne, Burlington, Jamestown Belgrade, Garner, Statesville Asheboro, Leaman Springs, South Sanford, Raleigh, Salisbury, Bessemer City, and Thomasville;

Nello L. Teer Co. of Durham, Raleigh, Wilson, Rocky Mount, Erwin and Wake Forest;

Vulcan Materials Co. (Mideast Div.) of Mocksville, Naples, Winston-Salem, Stoke Dal, Enka, Charlotte, Elkin, Wilkesboro, and Greystone;

North Carolina Granite Corp. of Mt. Airy.

TABLE 4

TYPES, QUARRIES, QUANTITY AND VALUE OF CRUSHED STONE PRODUCED IN NORTH CAROLINA, 1983 ("1983 US BUREAU OF MINES MINERALS YEARBOOK")

TYPE	QUARRIES	QUANTITY, M SHORT TONS	VALUE, M
Granite	58	26.8	$112.8
Limestone and dolomite			
- west	4	1.5	6.3
- east	6	3.1	15.3
Traprock	5	2.2	10.5
Marle, slate, quartzite	5	0.1	0.7
Total	78	33.7	145.6

Value:

In 1984, the average unit value of crushed stone produced in the state was $4.11 per short ton. This was down 5 percent from the 1983 value of $4.32.

As shown in Table 5 (1983 data) unit values varied significantly among end uses. The highest values were for poultry grit and mineral food, agricultural uses, filter stone, riprap and jetty stone, and bituminous surface treatment aggregate.

Consumption:

The primary uses for crushed stone, based on 1983 data, are graded road base or subbase, "other" (including agriculture limestone and sulfur oxide removal), coarse concrete aggregate, crusher run or fill or waste, and railroad ballast (see Table 6).

TABLE 5
UNIT VALUE OF CRUSHED ROCK FOR END USES, NORTH CAROLINA, 1983
("1983 US BUREAU OF MINES MINERAL YEARBOOK")

Use	Value Per Short Ton
Coarse aggregate (over 1.5 inch):	
Macadam	$3.44
Riprap and jetty stone	5.65
Filter stone	5.89
Coarse aggregate, graded:	
Concrete aggregate, coarse	4.73
Bituminous aggregate, coarse	4.61
Bituminous surface treatment aggregate	5.29
Railroad ballast	3.93
Fine aggregate (under 0.375 inch):	
Stone sand, concrete	3.82
Stone sand, bituminous mix or seal	2.07
Screening, undesignated	3.72
Coarse and fine aggregate:	
Graded road base or subbase	4.20
Unpaved road surfacing	4.43
Crusher run or fillor waste	3.36
Agricultural:	
Poultry grit and mineral food	10.67
Other agricultural uses	8.67
Special:	
Asphalt fillers or extenders	*
Other	4.50
Average	4.32

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* information withheld

TABLE 6
USES FOR CRUSHED ROCK PRODUCED IN NORTH CAROLINA, 1983
("1983 US BUREAU OF MINES MINERAL YEARBOOK")

Use	QUANTITY M Short Tons	Percent
Coarse aggregate (over 1.5 inch):		
Macadam	0.20	0.6
Riprap and jetty stone	0.26	0.8
Filter stone	0.06	0.2
Coarse aggregate, graded:		
Concrete aggregate, coarse	5.74	17.0
Bituminous aggregate, coarse	4.68	13.9
Bituminous surface treatment aggregate	0.85	2.6
Railroad ballst	1.66	4.9
Fine aggregate (under 0.375 inch):		
Stone sand, concrete	0.06	0.2
Stone sand, bituminous mix or seal	0.12	0.4
Screening, undesignated	1.49	4.4
Coarse and fine aggregate:		
Graded road base or subbase	7.34	21.8
Unpaved road surfacing	0.19	0.6
Crusher run or fill or waste	3.74	11.1
Agricultural:		
Poultry grit and mineral food	0.01	-
Other agricultural uses	0.06	0.2
Special:		
Asphalt fillers or extenders	0.01	-
Other	7.22	21.4
TOTAL	33.69	100.0*

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* Total does not equal 100.0 due to rounding

SOUTH CAROLINA
SAND AND GRAVEL

Production:

South Carolina's 1984 sand and gravel production was 5.8 M short tons, valued at $15.9 M. The 1984 quantity and values were up 11 percent and 6.0 percent respectively from 1983 values (5.2 M short tons and $15.0 M), marking the second year of increases from the recession year of 1982.

Nineteen counties yielded sand and gravel in 1983. Marlboro, Lexington and Lancaster were the leading counties, accounting for 36 percent of production.

Thirty-five companies produced sand and gravel from 41 operations. Leading companies were:
Becker Sand and Gravel Co. Inc. of Cheraw, Jefferson, Johnsonville, Brownsville, Bennettsville, and Sumpter;
Brewer Sand Co. Inc. of Pageland;
Foster-Dixiana Sand Co. of Dixiana;
Martin-Marietta Corp. of Lugoff; and
Whitehead Brothers Co. of Lugoff.

Value:

The average unit value of sand and gravel was $2.74 per short ton in 1984. This value was down 5 percent from 1983 ($2.88) and down 2 percent from 1982 ($2.79).

The variation of unit value with end use is presented in Table 1. The highest value uses, based on 1982 data, are asphaltic concrete and concrete products.

Consumption:

The largest single use by far for sand and gravel in South Carolina is concrete aggregate followed by asphaltic concrete and fill (based on 1982 data). Table 2 illustrates end use quantities.

TABLE 1
UNIT VALUE OF SAND AND GRAVEL PRODUCTS FOR END USES, SOUTH CAROLINA, 1982
("1982 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Value Per Short Ton
Asphaltic concrete	$3.75
Concrete products	3.54
Concrete aggregate	2.94
Other	2.36
Railroad ballast	1.59
Fill	1.34
Road base and coverings	1.20
Plaster and gunite sands	*
Average	$2.79

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* Information withheld included with "other"

TABLE 2
USES OF SAND AND GRAVEL PRODUCED IN SOUTH CAROLINA, 1982
("1982 US BUREAU OF MINES MINERALS YEARBOOK")

Use	M Short Tons	Percent
Concrete aggregate	2.35	49.7
Asphaltic concrete	0.93	19.7
Fill	0.84	17.8
Concrete products	0.36	7.6
Road base and coverings	0.11	2.3
Other	0.20	2.1
Plaster and gunite sands	0.03	0.6
Railroad ballast	*	0
Total	4.73	100.0**

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* Information withheld included with "other"

** Total does not equal 100.0 due to rounding

CRUSHED ROCK

Production:

For the second straight year, crushed rock production increased in South Carolina in 1984. Final production was 16.2 M short tons. This production compared to figures of 15.8 M short tons for 1983 (up 2.5 percent) and 14.0 M short tons for 1982 (up 16 percent).

The value of production was $63.0 M, making 1984 the third consecutive year of increase. Value was up 3 percent from 1983 ($61.1 M), 19 percent from 1982 ($53.0 M) and 26 percent from 1981. Crushed rock production represented 25 percent of South Carolina's nonfuel mineral value.

Stone was quarried in 19 of the State's 46 counties. The leading stone type was granite, produced mainly in nineteen northern counties. Limestone was also produced (see Table 3).

Leading producers are:

Vulcan Materials Co. of Gray Court, Pacolet, Lakeside, and Liberty;
Southern Aggregates; and
Martin Marietta of Berkeley, Cayce, Rock Hill, North Columbia, Georgetown and York.

Value:

The average unit value of crushed stone produced in South Carolina was $3.89 per short ton in 1984. This was almost the same value as in 1983 ($3.87) and 1982 ($3.79).

The variation of value with end use is presented in Table 4. The highest value was, based on 1983 data, railroad ballast, riprap and jetty stone, and coarse concrete aggregate.

Consumption:

The primary use categories in the state are "special: other", cement manufacture, and coarse concrete aggregate. "Special: other" includes coarse bituminous aggregate, fine aggregate (under 0.375 inch), coarse and fine aggregate, agricultural uses, sulfur oxide, removal, etc. (see Table 5).

TABLE 3
TYPES, QUARRIES, LOCATION, QUANTITY AND VALUE OF CRUSHED STONE PRODUCED IN SOUTH CAROLINA
("1983 US BUREAU OF MINES MINERALS YEARBOOK")

TYPE	QUARRIES	LOCATION	QUANTITY	VALUE
Granite	18	13 northern counties	9.9 M short tons	$42 M
Limestone	6	3 coastal counties	3.0	12
Limestone	1	Cherokee County (north)	-	-

TABLE 4
UNIT VALUE OF CRUSHED ROCK FOR END USES
SOUTH CAROLINA, 1983
("1983 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Value, Per Short Ton
Coarse aggregate (over 1.5 inch)	
riprap and jetty stone	$4.43
Coarse aggregate, graded	
concrete aggregate coarse	4.33
bituminous treatment aggregate	4.28
railroad ballast	4.73
Chemical and metallurgical	
cement manufacture	2.31
Special: other (including macadam, fine aggregate, agricultural uses, etc.)	4.13
Average	3.89

TABLE 5
USES FOR CRUSHED ROCK PRODUCED IN SOUTH CAROLINA, 1983
("1983 US BUREAU OF MINES MINERALS YEARBOOK")

	QUANTITY	
Use	M Short Tons	Percent
Coarse aggregate (over 1.5 inch) riprap and jetty stone	0.09	0.6
Coarse aggregate, graded		
concrete aggregate, coarse	2.28	14.4
bituminous surface treatment aggregate	0.65	4.1
railroad ballast	0.68	4.3
Chemical and metallurgical: cement manufacture	2.84	18.0
Special: other	9.25	58.6
Total	15.79	100.0

GEORGIA
SAND AND GRAVEL

Production:

There was no growth in sand and gravel production in Georgia in 1984. At 3.8M short tons, the production was the same as in 1983. However the figure was 20 percent higher than the production of 3.2M short tons in the recession year of 1982.

The value of 1984 production was $9.6M, an increase of 2 percent. Sand and gravel represented only 1 percent of the value of nonfuel mineral production.

Twenty-six counties produced sand and gravel in 1982. The leading counties were, in order, Crawford, Talbot and Seminole.

Production came from 32 pits operated by 29 companies. The pits were relatively small with none producing over 0.5M short tons. On the other hand, 89 percent of production came from the nineteen largest pits. As expected with small pits, output was dependent on the proximity of the pit to construction sites.

The largest producers were:
Atlanta Sand and Supply Co,. of Crawford county;
Brown Bros. Sand Co. of Howard;
Claussen Sand and Gravel Co. of Augusta;
Howard Sand Co. of Butler and Talbotton;
Brown Sand and Gravel Co. of Muscogee (dredge); and
Blankenship Sand Co. of Canton (dredge).

Value:

The average unit value of sand and gravel was $2.52 in 1984. This value was up only marginally from 1983 ($2.47) and down 5 percent from 1982 ($2.64).

Variation of unit value with end use is presented in Table 1. The highest value uses were road base and coverings, concrete products, and concrete aggregate.

Consumption:

The leading use of sand and gravel by far in Georgia is concrete aggregate, according to 1982 figures. Other large uses are road base and coverings and "other". "Other" includes asphaltic concrete and plaster and gunite sands (See Table 2).

TABLE 1
UNIT VALUE OF SAND AND GRAVEL PRODUCTS FOR END USES, GEORGIA, 1982
("1982, U.S. Bureau of Mines and Minerals Yearbook")

Use	Value, Per Short Ton
Concrete products	$2.77
Road base and coverings	2.77
Concrete aggregate	2.71
Plaster and gunite sands	2.36
Other	2.20
Asphaltic concrete	2.04
Fill	1.60
AVERAGE	2.64

TABLE 2
USES OF SAND AND GRAVEL
PRODUCED IN GEORGIA, 1982
("1982, U.S. Bureau of Mines and Minerals Yearbook")

Use	Quantity M Short Tons	Quantity Percent
Concrete aggregate	2.45	77.3
Road base and coverings	0.26	8.2
Other (including plaster and gunite sands and asphaltic concrete)	0.22	6.9
Concrete products	0.13	4.1
Fill	0.11	3.5
Plaster and gunite sands	*	*
Asphaltic concrete	*	*
TOTAL	3.17	100.0

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* Information withheld, included in "other"

CRUSHED STONE

Production:

Crushed stone production grew by 14 percent per year from 1982 to 1984 (34.8M short tons in 1982, 41.1M short tons in 1983, and 45.5 short tons in 1984).

Production was valued at $203M in 1984, an increase of 9 percent over 1983 and 33 percent over 1982. Crushed rock represented 21 percent of Georgia's nonfuel mineral production in 1984.

Crushed stone was produced in 43 counties in the state in 1982. Stone types utilized, included granite, marble, slate, limestone, and quartzite. Georgia leads the United States in the production of crushed granite and ranked second in the crushed marble. The granite industry was centred in the north-central-northeast portion of the state while the marble came from north (Gilmer, Pickens and Hall counties). Limestone production was concentrated in the northwest (four counties with six companies and six quarries) and the south (Lee, Houston and Miller counties; four companies and four quarries). Slate was produced in Polk county in the northwest (one company) while quartzite was produced in Richmond county in the east-central portion (one company). Further details are presented in Table 3.

Leading producing companies were:

Florida Rock Industries Inc. of Forest Park, Tyrone, Rome, Popes, Columbus and Rover;
Georgia Marble Co. of Douglasville, Lithonia, Cumming, Tate, Oxford, Whitestone and Dalton; and
Martin Marietta of Camak, Augusta, and Ruby.

Value:

In 1984, the average unit value for crushed rock in Georgia was $4.46, down slighty from the 1983 value of $4.53.

As shown in Table 3, unit values varied greatly with rock type. Marble and slate had unit values three to ten times those for granite and sandstone. The reason for the great variation is that much of the marble and slate is processed for high value uses such as paper filler and lightweight aggregate. Table 4 illustrates variation with end use.

Consumption:

Crushed stone in Georgia is consumed for a variety of uses, the largest being graded road base or subbase and coars concrete aggregate (See Table 5).

MARKET INTELLIGENCE

The Georgia Crushed Stone Association ran an extensive public relations campaign in 1983 focusing on state politicians. The message stressed "the role of the stone industry in the State's economy and growth". This campaign coincided with efforts by the Georgia General Assembly to regulate maximum load for trucks and to impose a mineral severence tax. Both issues would have affected adversely crushed stone and sand and gravel operators.

In another development, Florida Rock Industries Inc. was forced to close the quarry in Muscogee County after legal problems prevented a proposed expansion.

TABLE 3
DETAILS OF THE CRUSHED ROCK INDUSTRY IN GEORGIA, 1983
("1983, U.S. Bureau of Mines and Minerals Yearbook")

Type	Quarries 1981	Quarries 1983	Quantity, M Short Tons 1981	Quantity, M Short Tons 1983	Unit Value Per Short Ton 1981	Unit Value Per Short Ton 1983
Granite	44	43	28.0	33.9	$3.98	$4.27
Limestone	10	10	5.0	3.5	*	*
Marble	-	-	*	*	33.23	20.91
Slate	1	1	*	*	27.69	13.77
Quartzite	1	1	*	*	*	4.41
Sandstone	4	-	1.6	*	3.96	*

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* Information withheld to avoid disclosing proprietary data.

TABLE 4
UNIT VALUE OF CRUSHED ROCK FOR END USES, GEORGIA, 1983
("1983, U.S. Bureau of Mines and Minerals Yearbook")

Use	Unit Value, Per Short Ton
Coarse aggregate (over 1.5 inch)	
Macadam	*
Riprap and jetty stone	$5.01
Filter stone	*
Coarse aggregate, graded	
Concrete aggregate, coarse	4.90
Bituminous aggregate, coarse	4.44
Bituminous surface treatment aggregate	4.92
Railroad ballast	3.94
Other graded coarse aggregate	*
Fine aggregate (under 0.375 inch)	
Stone sand, concrete	4.31
Stone sand, bituminous mix or seal	4.24
Screening, undesignated	4.14
Other fine aggregate	*
Coarse and fine aggregate	
Graded road base or subbase	4.07
Unpaved road surfacing	4.48
Terrazzo and exposed aggregate	*
Crusher run or fill or waste	3.81
Other coarse and fine aggregate	*

TABLE 4 (continued)

Use	Unit Value, Per Short Ton
Agricultural	
Agricultural limestone	*
Chemical and metallurgical	
Cement manufacture	*
Special	
Other fillers or extenders	*
Lightweight aggregate	*
Other	6.04
AVERAGE	4.53

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* Information withheld, include in "other"

TABLE 5
USES FOR CRUSHED ROCK
PRODUCED IN GEORGIA, 1983
("1983 U.S. Bureau of Mines Minerals Yearbook")

	Quantity	
Use	M Short Tons	Percent
Coarse aggregate (over 1.5 inch):		
Macadam	*	*
Riprap and jetty stone	0.15	0.4
Filter stone	*	*
Coarse aggregate, graded:		
Concrete aggregate, coarse	6.86	16.7
Bituminous aggregate, coarse	4.69	11.4
Bituminous surface treatment aggregate	0.32	0.8
Railroad ballast	3.33	8.1
Other graded coarse aggregate	*	*
Fine aggregate (under 0.375 inch):		
Stone sand, concrete	2.05	5.0
Stone sand, bituminous mix or seal	1.53	3.7
Screening, undesignated	2.42	5.9
Other fine aggregate	*	*
Coarse and fine aggregate:		
Graded road base or subbase	9.46	23.0
Unpaved road surfacing	0.11	0.3
Terrazzo and exposed aggregate	*	*
Crusher run or fill or waste	4.28	10.4
Other coarse and fine aggregate	*	*

---

* Information withheld, included in "special: other".

TABLE 5 (continued)

Use	Quantity M Short Tons	Quantity Percent
Agricultural:		
Agricultural limestone	*	*
Chemical and metallurgical:		
Cement manufacture	*	*
Special:		
Other fillers or extenders	*	*
Lightweight aggregate	*	*
Other	5.90	14.4
Total	41.10	100.0 **

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* Information withheld, included in "special: other".

** Total does not equal 100-0 due to rounding.

FLORIDA
SAND AND GRAVEL

Production:

Sand and gravel produced increased by 23 percent in 1984 rising to 18.4 M short tons from 14.9 M short tons in 1983. It marked the second straight year of growth from the recession year of 1982 (13.6 M short tons).

The value of 1984 production was $42 M, an increase of 34 percent over 1983 ($31.5 M) and 40 percent over 1982 ($30.1 M). Sand and gravel represented 3 percent of the state's nonfuel mineral production.

During 1982, eighteen counties had operating sand and gravel pits. The leading counties were St. Lucie, Lake and Polk.

There were 25 producers operating forty pits in the state. Of these companies, the eleven largest produced 89 pecent of the sand and gravel in Florida. Leading producers were:

Florida Rock Industries Inc. of Jacksonville, Moore Haven, Atatula (dredge), Clermont, Brooksville, Lake Wales (dredge), and Keuka; General Development Corp.;
E. R. Jahna Industries Inc. (Ortona Sand Co. Div.) of Clermont, Labelle, Haines City, and Loughman (dredge);
Silver Sand Co. of Clermont Inc. of Clearmont (dredge).

Value:

Sand and gravel had an average unit value of $2.30 per short ton in 1984, up 9 percent from the 1983 value ($2.11).

There was a significant variation in unit value with end use (Table 1). The highest value uses were for asphaltic concrete and plaster and gunite sands.

Consumption:

The largest uses by far of sand and gravel were concrete aggregate and fill in 1982 (see Table 2).

TABLE 1

UNIT VALUE OF SAND AND GRAVEL PRODUCTS FOR END USES, FLORIDA, 1982

("1982 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Unit Value per Short Ton
Asphaltic concrete	$5.40
Plaster and gunite sands	3.33
Concrete products	2.53
Concrete aggregate	2.50
Road base and coverings	1.61
Fill	1.15
Average	$2.22

TABLE 2
USES OF SAND AND GRAVEL
PRODUCED IN FLORIDA, 1982
("1982 US BUREAU OF MINES MINERALS YEARBOOK")

Use	M Short Tons	Percent
Concrete aggregate	7.20	52.6
Fill	4.70	34.3
Plaster and gunite sands	0.76	5.8
Asphaltic concrete	0.64	4.4
Concrete products	0.38	2.9
Road base and coverings	0.07	0.7
Total	13.75	100.0*

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* Total does not total 100.0 due to rounding

CRUSHED STONE

Production:

Florida ranks second in crushed rock production in the United States. Production includes limestone, marl, and oyster shell. The latter is used mostly for roadbed material.

For the second consecutive year crushed stone production increased in 1985. Production reached 64.0 M short tons, up 12 percent from 1983 and almost back to prerecession values (65.1 M short tons in 1981).

The value of production in 1984 was $268.0 M, up 14 percent from 1983. Crushed stone was the second largest nonfuel mineral category in Florida and accounted for 18 percent of the state's nonfuel mineral value.

Crushed rock was produced in 24 counties in 1983. The leading counties were Dade, Hernando, and Broward, and accounted for 66 percent of the state's production.

Eighty-one companies operated 113 quarries in Florida in 1983. The fifteen largest quarries yielded over 1.0 M short tons each, totalling over 57 percent of production. Leading producers were:

Florida Crushed Stone Co. of Brooksville, Clermont, and Cabbage Grove;
Florida Rock Industries Inc. of Gulf Hammock, Jacksonville, Leesburg, Bushnell, Brooksville, Moore Haven, and Fort Myers;
Lone Star (Florida) of Hialeah;
Rinker Southeastern Materials Inc. of Miami, Pennsuco, and Sweetwater;
Vulcan Materials Co. of Miami, Medley and Hollywood.

Value:

In 1984 the average unit value of crushed stone produced in the state was $4.19 per short ton. This value was up only 2 percent from 1983 ($4.11) but 22 percent from 1982 ($3.43).

Consumption:

There are two major uses of crushed stone in the state, according to 1983 data: coarse concrete aggregate and graded road base or subbase. "Special: Other" is a collection of many miscellaneous uses (see Table 4).

TABLE 3
UNIT VALUE OF CRUSHED ROCK FOR END USES, FLORIDA, 1983
("1983 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Value, Per Short Ton
Coarse aggregate (over 1.5 inch):	
Riprap and jetty stone	$4.33
Filter stone	6.27
Coarse aggregate, graded:	
Concrete aggregate, coarse	4.64
Bituminous aggregate, coarse	5.17
Bituminous surface treatment aggregate	*
Railroad ballast	5.67
Fine aggregate (under 0.375 inch):	
Stone sand, concrete	4.60
Stone sand, bituminous mix or seal	5.60
Screening, undesignated	4.77
Other fine aggregate	*
Coarse and fine aggregate:	
Graded road base or subbase	2.65
Unpaved road surfacing	2.34
Crusher run or fill or waste	2.01
Other coarse and fine aggregate	*
Agricultural:	
Agricultural limestone	5.27
Poultry grit and mineral food	2.87
Other agricultural uses	*
Chemical and metallurgical:	
Cement manufacture	4.26
Lime manufacture	*
Special:	
Asphalt fillers or extenders	*
Whiting or whiting substitute	2.20
Other fillers or extenders	*
Other	4.74
Total	$4.11

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* Information withheld, included in "Special: Other"

TABLE 4
USES FOR CRUSHED ROCK
PRODUCED IN FLORIDA, 1983
("1983 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Quantity M Short Tons	Quantity Percent
Coarse aggregate (over 1.5 inch):		
Riprap and jetty stone	0.04	0.1
Filter stone	0.50	0.9
Coarse aggregate, graded:		
Concrete aggregate, coarse	15.78	27.5
Bituminous aggregate, coarse	2.44	4.3
Bituminous surface treatment aggregate	*	*
Railroad ballast	0.46	0.8
Other graded coarse aggregate	*	*
Fine aggregate (under 0.375 inch):		
Stone sand, concrete	3.52	6.1
Stone sand, bituminous mix or seal	1.03	1.8
Screening, undesignated	1.87	3.3
Other fine aggregate	*	*
Coarse and fine aggregate:		
Graded road base or subbase	12.77	22.3
Unpaved road surfacing	1.48	2.6
Crusher run or fill or waste	1.63	2.8
Other coarse and fine aggregate	*	*
Agricultural:		
Agricultural limestone	0.35	0.6
Poultry grit and mineral food	0.28	0.5
Other agricultural uses	*	*
Chemical and metallurgical:		
Cement manufacture	3.66	6.4
Lime manufacture	*	*
Special:		
Asphalt fillers or extenders	*	*
Whiting or whiting substitute	0.05	0.1
Other fillers or extenders	*	*
Other	11.42	19.9
Total	57.28	100.0

ALABAMA
SAND AND GRAVEL

Production:

For the second consecutive year, sand and gravel production increased in Alabama in 1983. At 9.1 M short tons it was up 6 percent from 1983 and 30 percent from 1982. Production was still short of prerecession levels, however.

The value of 1984 production was $25.4 M, up 8 percent from 1983 ($23.5 M) and 47 percent from 1982 ($17.2 M). Sand and gravel was the fourth largest nonfuel mineral category in Alabama in 1984 and contributed 6 percent of total market mineral value.

A large factor in Alabama's aggregate production has been the multi-billion dollar Tennessee-Tombigbee Waterway. Connecting the Tennessee River to the Gulf of Mexico, the nearly-completed canal system has used large amounts of crushed stone and sand and gravel. Its completion could depress aggregate markets in Alabama and nearby states.

Sand and gravel was produced in 24 counties in 1982 with the leading counties being Mobile, Montgomery, Elmore and Franklin.

There were 66 operations in 1982 in Alabama. Of these, the top 26 companies (31 operations) produced 85 percent of the sand and gravel. The industry is small scale in the state with no quarries producing over 1.5 M short tons and many working on an intermittent basis. In both 1982 and 1983 several quarries expanded operations, spending $0.7 M in 1982 and $0.8 M in 1983.

Leading producers were:

Holland and Woodward Co. Inc. of Holland and Woodward Stone Co. and Russellville;
R and S Materials Inc. of Montgomery;
Southern Industries, Radcliff Materials of Montgomery (pit and dredge) and Mobile (pit and dredge);
C.T. Thackston of Montgomery, Hardy Sand Co. Inc. of Tuscaloosa;
Waugh S & G Inc. of Pike Road.

Value:

In 1984, the average unit value of sand and gravel produced in the state was $2.79. This value was up only marginally (2 percent) from 1983 but up substantially (14 percent) from 1982.

Variation of value with end use was not as pronounced in Alabama as some other states. Highest value uses in 1982 were snow and ice control, concrete products, and concrete aggregate (see Table 1).

Consumption:

By far the largest use for sand and gravel in the state is concrete aggregate, according to 1982 data. Other large uses are asphaltic concrete and road base and coverings (see Table 2).

TABLE 1

UNIT VALUE OF SAND AND GRAVEL PRODUCTS FOR END USES

ALABAMA, 1982

("1982 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Unit Value, Per Short Ton
Snow and ice control	$3.47
Concrete products	2.96
Asphaltic concrete	2.59
Plaster and gunite sands	2.40
Other	2.27
Road base and coverings	1.93
Fill	1.37
Average	$2.45

TABLE 2
USES OF SAND AND GRAVEL
PRODUCED IN ALABAMA, 1982
("1982 US BUREAU OF MINES MINERALS YEARBOOK")

Use	M Short Tons	Percent
Concrete aggregate	3.99	56.8
Asphaltic concrete	1.03	14.7
Road base and coverings	0.95	13.5
Fill	0.65	9.3
Concrete products	0.37	5.3
Other	0.04	0.6
Snow and ice control	*	*
Plaster and gunite sands	*	*
Total	7.02**	100.0***

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* Information withheld, included with "other"
** Total does not equal 7.02 due to rounding
*** Total does not equal 100.0 due to rounding

CRUSHED STONE

Production:

Alabama has a large crushed stone industry. It has ranked second in the production of crushed marble (1982, 1983) and third in oyster shells (1983). In 1983, the state produced 42 percent of the crushed marble in the United States.

In 1984, production was 23.0 M short tons. This was an increase of 12 percent over 1983 (20.6 M short tons) and 8 percent over 1982 production.

The value of production was $103.5 M, equivalent to 25 percent of the value of the state's nonfuel mineral production. Crushed stone as the second leading category of nonfuel mineral production. The 1984 value was up 8 percent over 1983 ($95.4) and 16 percent over 1982 ($89.5) values.

Nineteen counties had crushed rock quarries in 1983. Leading counties were Shelby, Jefferson, and Colbert.

Unlike sand and gravel, Alabama has concentrated holdings in crushed rock. Of 47 operations, the top six produced over 1.0 M short tons each and accounted for over 38 percent of production. Of 27 companies, the top twelve produced over 90 percent of the state's output. The largest companies were:
Allied Products Co. of Alabster;
Hoover Inc. of Allsboro and Hollywood;
Ideal Basic Industries of Monroe;
Southern Stone Co. Inc. of Birmingham, Maylene, Monterallo, Calera, and Auburn; and
Vulcan Materials Co. of Oxford, Birmingham, Helena, Scottboro, Russellville, Bessemer, Tuscumbia, and Huntsville.

Value:

The average unit value of crushed stone produced in Alabama decreased in 1984, falling to $4.50 from $4.63 (1983).

Table 3 illustrates the variation of unit value with end use (1983 data). The highest value uses are: fillers or extenders (pulp and paper application for marble dust), whiting or whiting substitute (pulp and paper), cement manufacture and flux stone.

TABLE 4
UNIT VALUE OF CRUSHED ROCK FOR END USES
ALABAMA, 1983
("1983 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Value, Per Short Ton
Coarse aggregate (+1½ inch):	
Macadam	$ *
Riprap and jetty stone	3.69
Filter stone	4.30
Coarse aggregate, graded:	
Concrete aggregate, coarse	3.95
Bituminous aggregate, coarse	3.88
Bituminous surface treatment aggregate	4.37
Railroad ballast	*
Fine aggregate (-3/8 inch):	
Stone sand:	
Concrete	4.08
Bituminous mix or seal	*
Screening, undesignated	3.41
Other	*
Coarse and fine aggregate:	
Graded road base or subbase	3.53
Unpaved road surfacing	4.61
Terrazzo and exposed aggregate	*
Crusher run, fill or waste	3.94
Agricultural:	
Agricultural limestone	4.74
Other	*
Chemical and metallurgical:	
Cement manufacture	5.22
Lime manufacture	3.81
Dead-burned dolomite manufacture	*
Flux stone	5.06

TABLE 4 (continued)
UNIT VALUE OF CRUSHED ROCK FOR END USES
ALABAMA, 1983
("1983 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Value, Per Short Ton
Sulfur oxide removal	*
Special:	
Mine dusting or acid water treatment	*
Asphalt fillers or extenders	*
Whiting or whiting substitute	16.46
Other fillers or extenders	21.48
Roofing granules	3.59
Total	$4.64

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* Information withheld, included under "special: other"

Consumption:

Based on 1983 data, the leading uses of crushed stone produced in Alabama are cement manufacture, coarse concrete aggregate, and graded road base or subbase (see Table 4).

TABLE 4
USES FOR CRUSHED ROCK PRODUCED IN ALABAMA, 1983
("1983 US BUREAU OF MINES MINERALS YEARBOOK")

Use	M Short Tons	Percent
Coarse aggregate (+1½ inch):		
Macadam	*	
Riprap and jetty stone	0.60	2.9
Filter stone	0.10	0.5
Coarse aggregate, graded:		
Concrete aggregate, coarse	3.33	16.2
Bituminous aggregate, coarse	1.58	7.7
Bituminous surface treatment aggregate	0.14	0.7
Railroad ballast	*	*
Fine aggregate (-3/8 inch):		
Stone sand:		
Concrete	0.49	2.4
Bituminous mix or seal	*	*
Screening, undesignated	0.09	0.4
Other	*	*
Coarse and fine aggregate:		
Graded road base or subbase	2.37	11.5
Unpaved road surfacing	0.32	1.6
Terrazzo and exposed aggregate	*	*
Crusher run, fill or waste	1.66	8.1
Agricultural:		
Agricultural limestone	0.76	3.7
Other	*	*
Chemical and metallurgical:		
Cement manufacture	3.82	18.6
Lime manufacture	1.82	8.8
Dead-burned dolomite manufacture	*	*
Flux stone	0.16	0.8
Sulfur oxide removal	*	*

TABLE 4
USES FOR CRUSHED ROCK PRODUCED
IN ALABAMA, 1983
("1983 US BUREAU OF MINES MINERALS YEARBOOK")

Use	M Short Tons	Percent
Special:		
Mine dusting or acid water treatment	*	*
Asphalt fillers or extenders	*	*
Whiting or whiting substitute	0.25	1.2
Other fillers or extenders	0.44	2.1
Roofing granules	*	*
Other[2]		2.65
12.9		
Total	20.56**	100.0

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* Information withheld, included under "special: other"

** Total does not equal to 20.56 due to rounding

MISSISSIPPI
SAND AND GRAVEL

Production:

Mississippi's sand and gravel production has fluctuated around 10.5 M short tons over the last four years (10.5 M short tons in 1981, 9.5 M short tons in 1982, 11.0 M short tons in 1983 and 10.4 M short tons in 1984). Peak production occurred in 1970 with 17.0 M short tons.

Like Alabama, its industry was boosted by the Tennessee-Tombigbee waterway project, which has now been completed.

The value of production in 1984 was $30.1 M, a decrease of 15 percent from 1983 ($34.6 M). Sand and gravel accounted for 32 percent of Mississippi's nonfuel mineral value in 1984.

In 1982, the state had 69 active operations, 42 of which had processing plants. Most were small and none produced over 1.0 M short tons. The quarries were scattered among 32 counties.

Leading producers were:

American Sand and Gravel Co. of Hattiesburg;
Blain Gravel Co. of Crystal Springs, Prentiss, and Spring Vottage;
Hammett Gravel Co. of Lexington; and
Farrish Sand and Gravel Co. Inc. of Greenwood and Batesville.

Value:

An average unit value of $2.89 was received for sand and gravel in the state in 1984. This value was down 8 percent from the 1983 value of $3.15.

The highest value end uses were asphaltic concrete, concrete aggregates, and road base and coverings in 1982. Other uses and values are listed in Table 1.

Consumption:

There are three main uses of sand and gravel, according to 1982 data: concrete aggregates, asphaltic concrete, and road base and coverings.

TABLE 1
UNIT VALUE OF SAND AND GRAVEL PRODUCTS FOR END USES, MISSISSIPPI, 1982
("1982 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Value, Per Short Ton
Asphaltic concrete	$3.31
Concrete aggregates	2.81
Road base and coverings	2.76
Other	2.69
Concrete products	2.17
Fill	1.54
Plaster and gunite sands	*
Snow and ice control	*
Average	2.86

TABLE 2
USES OF SAND AND GRAVEL
PRODUCED IN MISSISSIPPI, 1983
("1982 US BUREAU OF MINES MINERALS YEARBOOK")

Use	Quantity M Short Tons	Percent
Concrete aggregates	3.32	35.1
Asphaltic concrete	2.94	31.1
Road base and coverings	2.29	24.2
Fill	0.51	5.4
Concrete products	0.27	2.9
Other	0.12	1.3
Plaster and gunite sands	*	*
Snow and ice control	*	*
Total	9.46**	100.0***

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* Information withheld, included on "other".

** Total does not equal 9.46 due to rounding.

*** Total does not equal 100.0 due to rounding.

CRUSHED STONE

Production:

Crushed stone production increased by 15 percent in 1984 going from 1.7 M short tons in 1983 to 1.9 M short tons in 1984.

The value of the state's 1984 production was $5.6 M, up 28 percent from 1983 ($4.4 M).

Five companies produced limestone and marl in 1983. They have twelve quarries in six counties. The three leading producers accounted for 95 percent of stone production. These producers were:
Mississippi Stone Products of Inka;
State Department of Agriculture and Commerce of Waynesboro; and
United Cement Co. of Loundes County.

Value:

The average unit value of crushed rock increased 11 percent from 1983 to 1984 going from $2.65 to $2.95. Unit values for end uses was not available.

Consumption:

Crushed stone is used for cement, aggregate, and agricultural purposes.

LOUISIANA
SAND AND GRAVEL

Production:

Louisiana produced 17.6M short tons of sand and gravel in 1984. Production was up 24 percent from 1983 (14.2 M short tons).

The value of sand and gravel production in 1984 was $67.2M. This represented an increase of 44 percent over the 1983 value of $46.6M.

Production occurred in 24 of the state's 64 parishes in 1982. The leading parishes were, in order, St Helena, St Tammany, East Baton Rouge, Webster, and Washington. These five parishes each produced over 1.0M short tons and accounted for 61 percent of production. St Helena alone produced 21 percent of the state's sand and gravel.

Louisiana's industry is characterized by many small (80 in all, 1982) and a few large producers. One producer accounted for over 1.0M short tons and seven produced over 0.5M short tons. In 1982, the six largest producers accounted for 40 percent of sand and gravel, the ten largest accounted for 61 percent. The largest companies were:

Gifford Hill and Co. Inc. of Fenton (dredge), Glenmora, Roseland, Tangipahoa, and Sibley;
Louisiana Sand and Gravel Co. of Grangeville (dredge);
Standard Gravel Co. Inc. of Pearl River (dredge), Clifton, Franklinton, and Warnerton; and
Texas Industries Inc. of Jena, Isabel (dredge), Perryville (dredge), and Tioga (dredge).

Value:

In 1984, $3.82 per short ton was the average unit value for sand and gravel produced in the state. This value was up 16 percent over the 1983 value of $3.28 and 24 percent over the 1982 value of $3.08.

Variation of unit values with end uses is illustrated in Table 1. In 1982, the highest value uese were asphaltic concrete, plaster and gunite sands, and concrete products.

Consumption:

The leading use by far of sand and gravel in Louisiana is concrete aggregate, according to 1982 data. (See Table 2).

TABLE 1

UNIT VALUE OF SAND AND GRAVEL PRODUCTS FOR END USES, LOUISIANA, 1982

("1982, U.S. Bureau of Mines and Minerals Yearbook")

Use	Unit Value, per Short Ton
Asphaltic concrete	$4.89
Plaster and gunite sands	4.06
Concrete products	3.24
Concrete aggregate	3.07
Road base and coverings	2.64
Snow and ice control	2.40
Fill	1.70
AVERAGE	$3.08

TABLE 2
USES OF SAND AND GRAVEL
PRODUCED IN LOUISIANA, 1982
("1982, U.S. Buread of Mines and Minerals Yearbook")

Use	Quantity	
	M Short Tons	Percent
Concrete aggregate	10.03	60.6
Road base and coverings	2.00	12.1
Asphaltic concrete	1.74	10.5
Fill	1.67	10.1
Concrete products	1.04	6.3
Snow and ice control	0.07	0.4
Plaster and gunite sands	0.01	0.1
TOTAL	16.56	100.0*

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* Total does not equal 100.0 due to rounding.

CRUSHED STONE

Production:

In 1984, 6.2M short tons of crushed stone was produced in Louisiana, an increase of 8 percent over 1983 (5.76M short tons).

The value of the 1984 production was $28.0M up 9 percent from 1983 ($25.7M).

Over 90 percent of the crushed stone was from crushed oyster shells in 1983. Production of shell was centred in Orleans and St Mary parishes (three companies and five operations). However, the practice of dredging shells is under strong attack due to adverse environmental effects. In 1984, the Governor of Louisiana imposed a two-year moratorium on new permits for dredging to allow time for study on its effect.

The other large crushed rock source was anhydrite gypsum in Winn County.

Leading producers in 1983, were:
Winn Rock Inc. of Winnfield (anhydrite);
Louisiana Materials Co. of New Orleans (dredge, shell);
Pontchartrain Dredging Corp of New Orleans (dredge, shell); and
Radcliff Materials of Lake Pontchartrain, Calumet, and Patterson (all dredge, shell).

Value:

At $4.52 per short ton, the unit value of crushed stone increased by only 1 percent over 1983 ($4.46).

The highest value uses were graded road base or subbase, unpaved road surfacing, and various special uses. (See Table 3).

Consumption:

The two leading uses of crushed stone in the state are graded road base or subbase and unpaved road surfacing according to 1983 data (See Table 4).